

## **Historic, Archive Document**

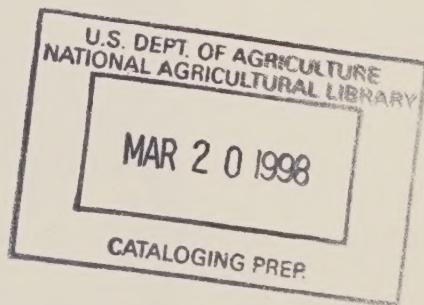
Do not assume content reflects current scientific knowledge, policies, or practices.



aSF481  
.J6

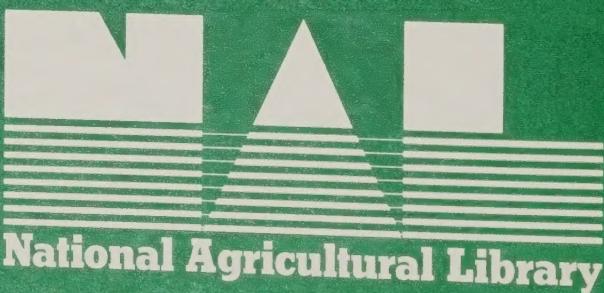
# A National Program of Research for

# POULTRY



Prepared by  
A JOINT TASK FORCE OF THE  
U. S. DEPARTMENT OF AGRICULTURE  
AND THE STATE UNIVERSITIES  
AND LAND GRANT COLLEGES

**United States  
Department of  
Agriculture**



**National Agricultural Library**

## FOREWORD

The United States Department of Agriculture and State Agricultural Experiment Stations are continuing comprehensive planning of research. This report is a part of this joint research planning and was prepared under recommendation 2 (page 204, paragraph 3) of the National Program of Research for Agriculture.

The task force which developed the report was requested to express their collective judgment as individual scientists and research administrators in regard to the research questions that need to be answered, the evaluation of present research efforts, and changes in research programs to meet present and future needs. The task force was asked to use the National Program of Research for Agriculture as a basis for their recommendation. However, in recognition of changing research needs it was anticipated that the task force recommendations might deviate from the specific plans of the National Program. These deviations are identified in the report along with appropriate reasons for change.

The report represents a valuable contribution to research plans for agriculture. It will be utilized by the Department and the State Agricultural Experiment Stations in developing their research programs. It should not be regarded as a request for the appropriation of funds or as a proposed rate at which funds will be requested to implement the research program.

- - - -

This report has been prepared in limited numbers. Persons having a special interest in the development of public research and related programs may request copies from the Research Program Development and Evaluation Staff, Room 318-E Administration Bldg., USDA, Washington, D.C. 20250.

November 1968

## TABLE OF CONTENTS

	<u>Page</u>
Preface .....	i

### INTRODUCTION

Framework of the Poultry Industry.....	1
Historical Trends.....	2
1. Eggs.....	2
2. Broilers.....	3
3. Turkeys.....	4
4. Other Species of Poultry.....	4
Future Needs for Poultry and Eggs .....	6
1. Eggs.....	6
2. Chicken and Turkey.....	6
3. Other Species of Poultry.....	6
Research Perspective.....	6
Fish Production and Marketing Research.....	7
Federal-State Relations.....	7
General Recommendations.....	7
Economics of Poultry Production and Marketing .....	9
Summary of SMY Recommendations.....	11

### RESEARCH PROBLEM AREAS

RPA 210 Control of Insects.....	14
RPA 211 Control of Diseases.....	16
RPA 212 Control of Internal Parasites.....	26
RPA 213 Protection from Toxic Chemicals.....	28
RPA 214 Protection from Air Pollution.....	30
RPA 310 Reproduction Performance.....	31
RPA 311 Feed Efficiency.....	40
RPA 312 Environmental Stress.....	49
RPA 313 Management Systems.....	53
RPA 409 Improved Consumer Acceptability.....	61
RPA 410 New and Improved Poultry Products.....	71
RPA 412 Quality Maintenance in Marketing.....	84
RPA 501 Improved Grades and Standards.....	89
RPA 505 Physical and Economic Efficiency in Marketing.....	91
RPA 707 Diseases Common to Man and Poultry.....	104
RPA 901 Utilization of Processing Waste..... (For Quality of Environment Task Force)	106

## PREFACE

## Poultry Research Needs Through 1977

Authority: The Joint Task Force on Poultry Research was appointed in memoranda of Dr. Ned D. Bayley, Deputy Director of Science and Education, dated February 14, 1968. The Agricultural Research Planning Committee had recommended the establishment of task forces to develop coordinated State-Federal plans for specified areas of research. Mr. A. G. Hazen, Chairman of the Experiment Station Committee on Organization and Policy, provided the list of State representatives selected to serve on the Poultry Task Force.

Membership:

USDA: Steven C. King, Assistant Director, Animal Husbandry Research Division, ARS -- Co-Chairman.

Eugene Gill, Assistant to Director, Animal Disease and Parasite Research Division, ARS.

Hans Lineweaver, Chief, Poultry Laboratory, Western Utilization Development Division, ARS.

Arthur J. Mercuri, Research Microbiologist, Field and Animal Products Branch, Market Quality Research Division, ARS.

George Rogers, Head, Poultry Group, ERS.

W. E. Shaklee, Staff Scientist, CSRS

SAES: W. H. Wiley, Dean, College of Agriculture and Biological Sciences, Clemson University, Clemson, South Carolina -- Co-Chairman.

M. G. McCartney, Head, Department of Poultry Science, University of Georgia, Athens, Georgia.

James McGinnis, Department of Animal Sciences, Washington State University, Pullman, Washington.

C. S. Shaffner, Head, Department of Poultry Science, University of Maryland, College Park, Maryland.

A. P. Stemberger, Department of Agricultural Economics and Rural Sociology, Pennsylvania State University, University Park, Pa.

E. L. Stephenson, Head, Department of Animal Sciences, University of Arkansas, Fayetteville, Arkansas.

Advisors: Oliver H. Peterson, Dr. Salsbury's Laboratory, Charles City, Iowa  
Larry E. Dawson, On leave from Michigan State University, CSRS.  
John Newman, Livestock Sanitary Laboratory, University of Maryland, Calvert Road, College Park, Maryland.

Staff Secretary: Max Hinds, Research Program Development and Evaluation Staff

Acknowledgement: The Poultry Task Force wishes to recognize the assistance of the following persons who generously gave of their time.

C. W. Hess, Chief, Poultry Research Branch, Animal Husbandry Research Division, ARS.

Benjamin F. Cox, Assistant to Director, Animal Disease and Parasite Research Division, ARS.

F. W. Dovres, Parasitological Laboratory, Animal Disease and Parasite Research Division, ARS.

Robert G. Hoffman, Insects Affecting Man and Animals Branch, Entomology Research Division, ARS.

Assignment: Poultry research in Research Problem Areas 210, 211, 212, 213, 310, 311, 312, 313, 409, 410, 411, 412, 501, 505 and 707 was assigned to the Task Force.

Within the general framework of the National Program of Research for Agriculture, October 1966, the Task Force was instructed to indicate areas of research which need emphasis and to determine the most efficient procedures for organizing and carrying out the specific research involved.

## INTRODUCTION

The poultry industry produces nearly one-tenth of the total cash receipts from farm products. Twenty years ago the swine industry had a commanding third place lead behind cattle and calves and dairy products among the animal industries, but in recent years poultry has edged into third place for cash receipts. Among the various principal crops or groups of crops, only feed crops with \$4.15 billion cash receipts exceeds or even comes close to the poultry industry's \$4.13 billion.

Since World War II the poultry raising has changed from millions of farm flocks to an industry composed mainly of large integrated operations utilizing the mass production technologies of the manufacturing industries. Profit margins are too low to be of much help to the farmer's wife in earning "pin money" from a backyard flock.

The poultry industry markets a variety of products. Eggs and broilers make up the principal source of cash receipts. However, turkeys, ducks, geese and other poultry bring in more than sheep and wool.

### Framework of the Poultry Industry

Industry organizations and government action programs play a prominent role in the development of the poultry industry and in the needs for research.

Since 1935 poultry producers have had the voluntary National Poultry Improvement and National Turkey Improvement Plans. These plans were authorized by the Congress and are administered by the Animal Husbandry Research Division, ARS, USDA, in cooperation with Official State Agencies. In the beginning, breeding improvement and *Salmonella pullorum* control received about equal emphasis. The breeding improvement phase of the plans developed a broad base of informed poultry breeders, largely from which sprung the highly scientific and specialized breeders of today. The program to control *pullorum* has been highly successful, having reduced the percentage of reactors from 3.7 to 0.001, the latter is only 381 reactors in over 38 million chickens tested. The turkey industry is ready to embark on a complete *pullorum-typhoid* eradication program.

The Animal Health Division, ARS, USDA, in cooperation with State Animal Health authorities assists in the *Salmonella* control program of the National Plans and works with producers and related industries not participating in the Plans on *Salmonella* control as well as on other poultry disease problems.

The Veterinary Biologics Division, ARS, USDA, plays a significant role in monitoring the production and sale of large quantities of vaccines used in poultry disease control.

The Consumer and Marketing Service, USDA, administers the poultry meat inspection program. This program has included only plants moving poultry products interstate, but recent legislation provides for equivalent state inspection which will bring substantially all poultry meat sold under ante and postmortem inspection.

The Packers and Stockyards Administration, USDA, monitors the operations of processors and distributors of poultry meat and eggs.

Market news reports play an important role in the orderly marketing of poultry and eggs.

The Secretary of Agriculture is authorized to develop and improve standards of quality, condition, size, and grade in order to encourage uniformity and consistency in commercial practices. Poultry meat and egg grading programs are in operation.

The actions of each of the above agencies should be based on proved research data.

The poultry industry has many organizations seeking to further its interests. There is no single organization that encompasses all segments of the industry; however, the rapid growth of the industry has kept it forward looking and for the most part, working toward common goals.

#### Historical Trends

1. Eggs: Eggs produced by hens and pullets of laying age during the year have increased from 118 per layer in 1926 to 218 in 1966. The increase has been rather steady and averages 2.5 eggs per year. The Nation's laying flock is somewhat smaller now than in the late 1920's, yet nearly twice as many eggs are produced.

Feed is the largest cost item in producing eggs. USDA estimates about 60 feed units per 100 eggs produced for the period 1910 through 1952. Since then, feed units required have declined to about 50. Poultrymen think in terms of feed per dozen eggs or feed per pound of eggs. The 50 feed units above would translate into about 6 pounds of feed per dozen eggs, a figure considered high by today's standards; however, more than a pound of feed in that figure comes from that consumed in replacing the laying flock each year. The Nation's random sample tests averaged 4.7 pounds of feed per dozen eggs or 3.01 pounds of feed per pound of eggs in 1966, including heavy breed entries. It used to take close to 7 pounds of feed per dozen eggs.

Total production costs were estimated by USDA at 29.3¢ per dozen eggs in 1967. This compared with 37.1¢ in 1950.

Egg marketing is changing rapidly. The time required from nest to consumer is decreasing. Grading, packing, assembling and transporting technologies and methods have changed. Big city markets and storage no longer influence the market the way they did. USDA estimated the marketing costs between the farmer and the consumer at 22¢ per dozen in 1967. In contrast to many other agricultural commodities, marketing costs for eggs and poultry have remained steady or decreased slightly during the past two decades, despite substantial increases in wage rates and other inputs. Per capita egg consumption hit a peak of 403 in 1945. There was a big slump the next year and then a return to 393 eggs per capita in 1951. Since then, there has been a steady decline to the 313 eggs per capita consumption of 1966.

2. Broilers: The broiler industry had its beginning in the 1930's, but it was 1952 before broiler production exceeded other chickens. Commercial broiler production in 1966 was 6,465 million ready-to-cook pounds, more than 10 times the production of 1947, while other chickens at 838 million pounds was only 40% of their 1947 production. Broiler production is highly concentrated in the Delmarva, Southeastern and South Central areas of the country. It is also a highly integrated industry, with hatchery, grower, feed dealer and processor either completely integrated or very closely coordinating their activities through financing or contractual relationships.

Breeding and feeding research has resulted in 3.5 pound broilers in 8 to 9 weeks compared with 13 or 14 weeks of age prior to 1950. Feed units per pound of gain have dropped from over 5 to about 3. A recent random sample broiler test in Arkansas produced 3.75 pound broilers in 8 weeks on 1.94 pounds of feed per pound of gain.

With such gains in efficiency, the average price per pound for broilers has dropped from 32.3¢ per pound in 1947 to 15.3¢ in 1966. In 1967 chick cost was 2.6¢, feed 9¢, labor 0.7¢, and other costs 1.8¢ for a total of 14.1¢ per pound of broiler produced. This is about half the level of production costs in 1950.

Formerly New York Dressed was the preferred product marketed, but today it is ice packed eviscerated. Cut up chicken is increasing its share of the market. Frozen chicken has not caught on to the extent that frozen turkey has. Further processing is steadily increasing. Marketing, including processing and transportation, of ice packed broilers ran about 21¢ per pound in 1967.

Consumption of chicken meat was 18.1 pounds per capita in 1947 and 36.0 in 1966. This doubling of consumption is due to broilers, since fowl and other chicken meat production has fallen to 40% of the 1947 level. Since 1947 beef consumption has increased 49%, but this represents an actual increase of 34.2 pounds per capita. Meanwhile, consumption has declined about 58% for veal, 25% for lamb, and 14% for pork.

3. Turkeys: The turkey industry has grown rapidly, though not as fast as the broiler industry. Production has more than tripled from 485 million ready to-cook pounds in 1947 to 1,678 million pounds in 1966. Turkeys are produced throughout the United States, but production is concentrated in a few states. The 9 leading states, each producing over 5 million turkeys a year, made up 70% of the U. S. total in 1966. These nine states are fairly well distributed over the U. S.

While price per pound live weight fluctuates with volume of production, its trend reflects increasing efficiencies in production of turkeys. It has dropped from 36.5¢ per pound in 1947 to 23.0¢ in 1966. In 1967 poult cost was 3.3¢, feed 13.5¢, labor 1.0¢ and other costs 2.2¢ for a total of 20¢ per pound of heavy-type turkey produced. This is about 40 percent lower than 1950 production costs.

Like broilers, turkey marketing has shifted from New York dressed to ready-to-cook basis. However, turkey marketing differs in that consumers readily accept frozen turkey products. There has been a great increase in further processed products such as turkey logs or rolls. Further processed turkey increased 127 percent from 1961 to 1966. The needs of the further processed industry and the restaurant trade has had an influence on the type of bird produced. The popularity of the small family type turkey has declined from 25% of the market to about 10%. Marketing, including processing, freezing, storage and transportation, of ready-to-cook heavy-type turkeys ran about 22¢ per pound in 1967.

Turkey consumption per capita has grown from 3.6 pounds in 1947 to 7.8 pounds in 1966.

#### 4. Other species of poultry:

Ducks - Long Island ducklings or ducks of this type constitute the majority of ducks produced. About 12.5 million ducks were raised in 1964. The Long Island duck industry is concentrated in the hands of about 55 farms on the Island. Population pressures and pollution problems are a menace to producers there. Ducks have a consumer acceptability problem, being too fat and having a low yield of edible meat.

Geese - The goose industry has not developed in the United States. There are probably many reasons for this, including the poor reproductive rate of geese, the high fat content of mature geese, and the relatively low amount of edible meat on the carcass. Geese can be raised in all parts of the United States but the largest share of the 1 million raised (1964) is in the North Central States. The largest producer, until recently, was a pecan farm at Las Cruces, New Mexico, which produced as many as 200,000 geese a year. One farm in Wisconsin produces about 15,000 and processes 30,000 geese each year. There is a relatively good demand for geese, especially at Thanksgiving and Christmas, in large cities among people of European ancestry.

Geese could be developed into a profitable specialty product, provided the reproduction rate can be improved and the meat quality improved. Housing and management requirements are generally low, and they can be reared economically. Geese are frequently used for weeding in strawberry and cotton fields.

Guinea Fowl - Relatively few guinea fowl are raised in the United States, especially on a commercial scale. Specific information on the number of guineas raised is not available, but probably does not exceed a quarter of a million, mostly in flocks of less than a hundred.

Guineas are raised as a specialty food and are used as guards for farms, commercial business and prisons. They give a loud, harsh cry when strangers appear.

Practically no research work is done with guineas. Studies are required on improving the reproductive rate of guineas. More eggs per bird and a longer laying period are necessary to make the industry more profitable.

Pheasants - Pheasants are raised for release by game clubs and some for food. The Ringneck Pheasant is the most common. There are no data available on pheasants grown commercially in the U. S.

The demand for pheasant meat as a specialty item is great but many production problems exist. Pheasants are difficult to raise in confinement and costly housing is required. The reproduction rate is low and must be improved before growing pheasants can become an important, profitable industry.

An additional problem is that pheasants raised in confinement are not able to survive when released in nature nor do they react favorable to hunters when released. Better management procedures are needed.

Squab raising - Squab (young pigeons 25 to 30 days of age) are produced in limited quantities throughout the United States, but primarily in the Northeastern and Southeastern States and on the Pacific Coast. The largest producer is Palmetto Pigeon Plant, Sumter, South Carolina. This plant has 32,000 breeders and produces about 175,000 squab annually.

Squab production does not require expensive equipment and should be adaptable for certain low income areas not too far removed from large cities. Little or no research is in progress on squab raising.

Other fowl, such as Bobwhite and quail, offer an excellent opportunity as a specialty product. Many management and production problems exist which must be solved by research. These include economical housing or restraining, improving reproduction, and improving the feeding and care of the birds. Bobwhite, quail and other small birds are used extensively in genetic, physiologic and nutrition programs in support of chicken or turkey research.

Future Needs for Poultry and Eggs:

The Poultry Task Force believes that a review of projected 1980 production and consumption data will help in evaluating future research needs. Figures cited in this section were taken from "Statistical Supplement to A Look Ahead for Food and Agriculture," prepared recently by the Economic Research Service, USDA.

1. Eggs - Production of 6,330 million dozen eggs is projected for 1980, even though a further decline in per capita consumption from 314 in 1964 to as low as 290 in 1980 is predicted. This domestic consumption would provide for a net export of 29 million dozen and an increase of 52 million dozen for nonfood uses, up from 312 million dozen in 1964. Indications are that export and carryover stocks will remain about the same as in 1964.

2. Chicken and Turkey (ready-to-cook) - A sizable increase from 7.68 billion pounds in 1964 to 11.49 billion pounds in 1980 is projected. Carry-over stocks are projected to be more than triple the 1964 level of 207 million pounds and exports would be up 37 million pounds. This level of production, export, and carryover would provide for 45.5 pounds per capita in 1980 compared with 38.5 pounds in 1964. With 1966 chicken and turkey consumption already at 43.8 pounds, it would appear that the 1980 projection is too conservative, since there is little indication of a slackening demand for poultry meat at the favorable prices offered. The Task Force believes that per capita consumption of chicken and turkey may exceed 50 pounds by 1980. This consumption level would require over 1.1 million pounds more chicken and turkey than the 1980 projection shown previously.

3. Other Species of Poultry - No projections for 1980 have been made for ducks, geese, guinea fowl, pheasants and squab. Only through a considerable expansion of research on the consumer acceptability problems of ducks and geese could we expect much change in per capita consumption. For the other specialty fowl, the real problems are efficiency of production and merchandizing. Significant advances in these fields could excite real growth in these species.

Research Perspective: No one can deny that poultry research has paid off. The very great strides in broiler production and processing efficiency are known by everyone, at least by way of the remarkable price reductions that have benefited consumers and resulted in greatly increased per capita consumption. Less spectacular, but similar gains have been made in turkey and egg production. Frozen turkey and further processed turkey products have been a real boon to turkey sales. While most food prices have increased, poultry product prices in retail stores are lower than early post World War II days.

Opportunities for further gains generated by research still exist. An excellent example is broilers. A recent Arkansas random sample broiler test produced 3.75 pound broilers in 8 weeks on less than 2 pounds of feed per pound of gain. Further gains in reproduction and feed efficiency are almost inevitable if we continue our research efforts. More gains can be expected through reducing condemnation losses due to airsacculitis and the leukosis complex. The egg production industry can make gains in efficiency through disease control, better reproduction performance, feed efficiency, environmental management, improved egg shell quality and waste management.

Similar opportunities exist for turkeys, ducks, geese and other fowl.

Further improvements can be made in handling and transporting poultry to processing plants. At these plants new technologies can add even more advances. Marketing and further processing of dressed poultry can be improved. New products that offer variety and stimulate demand are possible.

In short, opportunities for increased efficiency and product improvement abound at every stage in the production, processing, and marketing of poultry products. These opportunities only await sufficient research input to be realized.

Shifts in emphasis have been the rule rather than the exception in poultry research. In the field of poultry nutrition, we had early emphasis on vitamins. As vitamins were discovered and requirements for them established, we moved on to minerals, then energy needs and protein requirements, followed by refinement in amino acid requirements, and more recently fatty acids.

The poultry industry has been quick to capitalize on new technologies, and researchers have been quick to follow new leads that offered promise of solving remaining problems. An industry of this magnitude and scope deserves far more research effort than is currently being exerted.

Fish Production and Marketing Research: The Poultry Task Force believes that fish farming deserves attention by the Department of Agriculture. This industry offers many opportunities that tie in well with crop or animal production. Fish farms in the Orient make substantial contributions to quality protein food production. Fish are raised in rotation with rice and animal wastes are disposed of in fish ponds for fish food and fertilizer.

Production of fish has much in common with poultry production. Fish hatchery operations are not so far removed from chicken hatcheries as it might seem. Grow-out operations, feeding complete diets, and processing and marketing the fish harvested also have features in common with poultry.

The Task Force wonders who is helping the fish farmer. It believes that poultry researchers could make a contribution by conducting and managing a fish farming research program.

Fish farming could be developed in rural areas, providing new opportunities and industry where little competition exists.

Federal-State Relations: Federal-State relations in Poultry Research have been good. However, better coordination could be achieved in some research areas. Regional projects in poultry breeding, physiology, environment, diseases, and marketing have been particularly effective in promoting exchanges of information and attaining jointly planned research programs.

The Poultry Task Force believes that an excellent spirit exists for cooperatively planning poultry research programs. The Task Force would like to see emphasis given to National research planning committees, each of which devotes its efforts to one or a few closely related research problem areas. Such committees, composed of State Station representatives from each region, USDA and industry, could work out the approaches needed to meet the objectives and goals of the future and lay out the framework for a coordinated attack on the research problems to be solved.

In the plant sciences, many USDA scientists are located at the State Experiment Stations on a cooperative basis. More of this type of cooperative effort should be employed in the animal sciences.

Equally important is the thought that State Experiment Station personnel could be cooperatively located in USDA laboratories located on or near Land-Grant college campuses.

The Poultry Task Force believes that both a Federal and a State Station effort in research is needed in order effectively to meet local, state, regional and national needs on a coordinated basis, with each doing that which it is best equipped to do.

General Recommendations: The Poultry Task Force agreed with the allotment of research effort made by the Long Range Study and later divided between SAES and USDA for most RPA's. However, it felt that several RPA's did not receive the consideration deserved when they were studied in greater depth. Except for RPA 312, the changes recommended by the Poultry Task Force were not very large, so the 1972 and 1977 SMY recommendation reflects the Task Force's evaluation of research needs. The Task Force believes that the research needed in RPA 312 was seriously underestimated in the Long Range Study, in view of the problems being encountered in controlled environment for poultry.

The Task Force recommends that the research effort for problem area 312-Environmental Stress, be increased considerably more than that recommended by the Joint Task Force. This recommendation is based on the interest and importance being given to this area of research at some of the State Experiment Stations. Alabama, Arkansas, Maryland, and Texas, for example, have expanded their facilities for research in this area in recent years. The Task Force believes that increased emphasis in this area of research is justified because of the improvement in productivity that would be possible by obtaining a better understanding of the role of environmental factors and the relationship of these to the design of housing and equipment for the most efficient production of meat and eggs.

The Task Force has been assured that the concern of the poultry industry in RPA's 701, 702, and 708 is being given adequate attention by other Task Forces. RPA 702, in particular, deserves considerable emphasis, because poultry and egg products are an excellent media in which harmful microorganisms may multiply and present the industry with a public health responsibility.

The Task Force felt there was sufficient need and promise for research to find uses for poultry processing waste that a detailed proposal for RPA 901 is included at the end of this report for consideration by the Quality of Environment Task Force.

Economics of Poultry Production and Marketing: The development of new technology, methods, and products for the poultry and egg industries requires extensive economic analysis to determine how this basic information can be translated into commercial application. Various alternative methods of producing and marketing need to be evaluated to determine their effects on producer returns, marketing costs, and prices to consumers. Moreover, as the overall characteristics of the poultry and egg industries change from internal or external causes, producers and marketing firms need continuing guidelines to enable them to perform effectively and efficiently in this changing environment.

Thus, the Task Force considered it desirable to outline a complete program of research in the area of marketing and production economics to parallel that developed in the areas of protection, production, and product development. This program involves work both in RPA's 501 and 505 and RPA's 506, 507, 508, 509, 510, 601, and 807. It is evident that much of the ongoing work in marketing and production economics is included under these latter RPA's. In 1966, a total of 26 scientific man years was identified under RPA's 501 and 505. It is estimated that there were an additional 36 scientist man years included under other RPA's engaged in some aspect of economic research applicable to poultry.

Subsequent comparisons are presented both in terms of specific RPA's and by work projects. It is hoped these will both: (1) assure that problems specific to the poultry industry will receive proper attention in research planning endeavors; and (2) be of assistance to other task forces concerned with functional areas in distinguishing between work with specific commodity orientation as well as that of cross-commodity or general functional nature.

Table 1 shows the scientist man years required in the proposed program of research in poultry and egg marketing and production economics, classified according to research problem areas.

Table 1. Summary of scientist man years in poultry and egg marketing and production economic activities by research problem areas, 1966, 1972, 1977

Code	Research Problem Areas Short Title	Year		
		1966	1972	1977
501	Improvement of grades and standards	3	4	5
505	Physical, economic efficiency, poultry marketing	23	24	26
506	Supply, demand, price analysis	8	8	10
507	Competitive interrelationships	3	3	3
508	Development of domestic markets	6	6	6
509	Marketing firm and system efficiency	11	12	17
510	Farmer bargaining power	3	4	4
601	Expansion of foreign markets	4	5	6
807	Structural changes in agriculture	1	2	2
	Total	62	68	79
	Total RPA's 501, 505	26	28	31
	Total other RPA's	36	40	48

The Task Force concurs with the recommended SMY's allocated to RPA's 501 and 505. These would involve a modest increase in resources devoted to research on improvement in grades and standards (501) from 1966 through 1972 to 1977. Work on physical and economic efficiency in poultry and egg marketing would involve a modest increase in work on physical efficiency, but a relatively stable commitment on economic efficiency studies. However, the work on economic efficiency would involve a decrease in studies relating to single firms and functions, and an increase in studies relating to systems, coordination, structure and performance.

In terms of work now classified under RPA's other than 501 and 505, the Task Force recommendations involve (1) a stable level of commitment on domestic market development and expansion; (2) a modest increase in resource on development and expansion of foreign markets; and (3) modest increases in work related to systems, coordination, structure, performance, and price, supply, and demand studies.

There were 463 scientist man years associated with RPA's 506, 507, 508, 509, 510, 601, and 807 in 1966. By 1977, this was estimated as 760 scientist man years in the projections associated with the national report, or an increase of 64 percent. Work specific to the poultry industry under these RPA's would be increased from 36 to 48 over the same period, or an increase of 33 percent. Thus, this rate of increase is less than half of that for the overall categories.

Table 2 summarizes the scientist man years required for the proposed program of research in poultry and egg marketing and production economics by work projects and by research problem areas under each work project. These work projects are outlined in detail in the following pages.

Summary of SMY Recommendations: The attached table shows the RPA's considered by the Poultry Task Force. It gives by RPA the 1966 base for SAES and USDA and the total effort proposed by the joint committee representing ESCOP and USDA. In addition, it shows the SMY proposed in 1972 and 1977, where they differ from the recommendations made in Chicago, July 21-22, 1967.

Benefits of Research: Since there is no way to determine in advance what portion of the recommended program will be implemented, all estimates of benefits are made individually by research problem area or sub-area without regard to changes that might be made by new technology in other RPA's. Thus, benefits are not additive over all RPA's. Also, there are vastly differing degrees of validity of estimates, some being based on fairly good data, others having little supporting data.

Table 2. Scientist man years in poultry and egg marketing and production economic activities by task force proposed work projects and research problem areas

Proposed Task Force Work Projects and Research Problem Areas	Year 1966	Year 1972	Year 1977
Improvement of grades and standards - 501 (501)	3 (3)	4 (4)	5 (5)
Physical efficiency - 505A (505)	3 (3)	4 (4)	6 (6)
Economic efficiency - 505B (505) (509)	17 (11) (6)	16 (10) (6)	14 (8) (6)
Coordinating production, input-supplying and marketing - 505C (505) (509) (510)	7 (2) (4) (1)	11 (6) (4) (1)	14 (6) (7) (1)
Dynamics of industry structure and performance - 505D (505) (507) (509) (510) (807)	7 (1) (3) (1) (1) (1)	11 (2) (3) (2) (2) (2)	14 (3) (3) (4) (2) (2)
Pricing poultry, eggs and related products - 505E (505) (506) (510)	15/ (6) (8) (1)	11 (2) (8) (1)	14 (3) (10) (1)
Development and expansion of foreign markets for eggs and poultry products-505F (601)	4 (4)	5 (5)	6 (6)
Development and expansion of domestic markets for eggs and poultry products-505G (508)	6 (6)	6 (6)	6 (6)

Explanation: Research problem area codes and associated man years are shown in parentheses. Task force proposed work projects and associated man years are shown without parentheses.

1/ Level of effort reflects special funds appropriated by Congress for research in egg pricing. Normal level would be about 9 man years.

**JOINT TASK FORCE ON POULTRY RESEARCH**  
**Summary of Inventory and Recommended SMY's**  
**with Adjustments Proposed by the Task Force**

Research Problem Area	1966 <u>1/</u>			1972 <u>2/</u>			1977 <u>2/</u>			TF 5/
	SAES	USDA	TOTAL	SAES	USDA	TOTAL	SAES	USDA	TOTAL	
210 Control of Insects	3	3	6	5	4	9	7	6	13	
211 Control of Diseases	77	25	102	98	31	129	120	38	158	
212 Control of Parasites	5	5	10	9	10	19	14	16	30	
213 Protection from toxic chem.	2	3	5	2	4	6	3	6	9	
214 Protection from Air Pollution:	-	-	-	-	-	2	-	-	-	3
707 Prevent Disease Transmission to Man <u>3/</u>	-	-	-	-	-	-	-	-	-	
Subtotal - Protection	-	-	-	-	-	-	-	-	-	
Subtotal - Reproductive Performance	-	-	-	-	-	-	-	-	-	
310 Feed Efficiency	125	8	133	130	9	139	137	9	146	
312 Environmental Stress	29	5	34	32	5	37	37	6	43	60
313 Improving Management Systems	25	7	32	29	8	37	36	11	47	51
409 Improving Consumer Acceptance:	5	1	6	3	1	16	17	4	21	
Subtotal Product	211	25	242	245	30	275	293	26	308	338
Food Products	22	22	44	25	25	50	59	28	56	70
412 Quality Maintenance	7	7	7	8	8	12	11	8	11	16
Subtotal Product Development	-	-	-	-	-	-	-	-	-	-
Subtotal Standards & Grades	-	-	-	-	-	-	-	-	-	-
501 Efficiency in marketing <u>4/</u>	13	15	28	14	15	29	15	16	31	5
Subtotal Marketing	15	16	31	16	17	33	17	19	36	
GRAND TOTAL	348	99	452	408	121	537	557	472	149	682

1/ Inventory of Agricultural Research, Column 1, Table I, June 1967

2/ A joint committee representing the Experiment Station Committee on Organization and Policy and the USDA met in Chicago on July 21-22, 1967, to review manpower allocations and recommended the SMY's shown.

3/ In 1966, 16 SMY's were engaged in this problem area which included all livestock and poultry. The joint committee recommended 12 additional SMY's for 1977 - all to be added by 1972 but did not allocate by species.

4/ The adjustment in 1966 inventory was made by additional allocations to the problem area not shown in the inventory - estimated by the Task Force subgroup.

5/ New totals for problem areas adjusted by the Task Force at a meeting held March 27-29, 1968.

## POULTRY RESEARCH PROBLEMS

TITLE: Control of insect and insect-like external parasites of poultry.  
RPA 210.

SITUATION: The biology of several of the external parasites of poultry is incompletely known and this lack of knowledge seriously hinders the development of satisfactory control measures. Although insecticide controls have been developed for external parasites of poultry, in many instances, tolerance to the insecticides, residue in meat and eggs, toxicity to the bird, and unsatisfactory methods of application invalidates their use for the intended purposes. These external parasites are common intermediate hosts of diseases and parasites, e.g., leucocytozoon infections and tape-worms, and, as such, constitute a serious potential hazard in areas where the diseases and parasites are enzootic.

OBJECTIVE:

- A. To determine the basic life history on those arthropoda and acarina affecting poultry, including poultry species of lesser economic importance (e.g., ducks, and geese).
- B. Evaluate methods of control.

RESEARCH APPROACHES:

- A. Ecological studies of the insect and insect-like external parasites of poultry, including basic studies in disease transmission by insects as to species involved, the hosts and alternate hosts, the effect on poultry, and the environmental conditions required for the transmission of these pests.
- B. Evaluation of promising toxicants, including methods of application and residual levels in meat and eggs.
- C. Evaluation of control methods through manipulation of the environment bacteriological agents, or other biological control measures such as reproductive sterilization.
- D. Evaluation of insect pests of poultry of lesser economic importance.

CHARACTER OF POTENTIAL BENEFITS:

The control of external parasites of poultry will result in improved production and higher grade products.

MAGNITUDE OF POTENTIAL BENEFITS:

Lower production costs are estimated to be at least \$100,000,000 annually.

<u>RESEARCH EFFORT</u>	<u>INVENTORY</u>	<u>T F RECOMMENDATION</u>	
		<u>1966</u>	<u>1972</u>
SAES	3		5
USDA	3		4
Total	6		9
			13

CONTROL OF DISEASES OF POULTRY RPA 211

TITLE: Control of the avian leukosis complex in poultry. RPA 211-A.

SITUATION: The highly efficient poultry industry is seriously threatened by losses from diseases of the avian leukosis complex, the most costly and serious of all poultry diseases. Its devastating spread continues unabated. Approximately 35% of all condemnations in 1967 were attributed to avian leukosis. Condemnations because of avian leukosis have increased from 6.5% of all broilers condemned in 1962 to 35.2% in 1967. The number of broilers condemned annually during this same period in successive years since 1961 was 1.7, 2.4, 4.1, 8.2, 10.8, 20.7, and 29.6 million birds. Individual commercial broiler growers have reported condemnations due to avian leukosis as high as 21.5%. The poultry industry is being seriously threatened by these losses and the broiler industry cannot survive if these losses continue to increase. Research on the avian leukosis complex is extremely difficult. Recent findings indicate it is caused by at least two groups of viruses. Lymphoid leukosis is a malignant disease affecting birds as adults. Marek's disease is an acute disease affecting birds during early life. So called "skin leukosis" is considered a form of Marek's disease and a major cause of condemnation losses. Current research efforts have produced new and important leads which offer promising approaches to a better understanding of this complex disease. Extra costs of production inputs due to diseases of the avian leukosis complex approach \$190.3 million annually. Major types of losses include condemnations in broilers and mature birds, mortality, and 5% losses in egg production. Skin leukosis is a major cause of condemnation at slaughter. It is essential to determine if the skin lesions are leukotic and if they affect the wholesomeness of the carcass.

OBJECTIVE: Reduce the annual losses due to diseases of the avian leukosis complex by increasing genetic resistance of birds, by establishing a management system which will reduce the spread of the disease and the source of the causative agents, by developing effective vaccines, and by developing procedures for testing for infection and identifying infected birds.

RESEARCH APPROACHES: Basic and applied research is required to determine the characteristics of the causative agents (viruses), and to develop methods for identifying the presence of the agent in birds and for the prevention of losses due to the diseases. It includes a program in poultry husbandry, virology, pathology, immunology, epizootiology, and genetics of resistance to the neoplasms of the avian leukosis complex. Some specific approaches include:

- A. Increasing resistance of poultry to avian lymphoid leukosis.
- B. Increasing resistance of poultry to Marek's disease.

- C. Identify causative agent of "skin leukosis" and determine whether it is a leukotic tumor.
- D. Conduct epizootiological studies to determine prevalence of infection and possible reservoirs of infection.
- E. Develop management systems for reducing and eliminating the disease.
- F. Determine the importance of various stress factors in the spread of lymphoid leukosis and Marek's disease.
- G. Develop rapid methods for detecting the causative agents and antibodies of lymphoid leukosis and Marek's disease.
- H. Develop methods for rapidly identifying birds resistant and susceptible to the two diseases.
- I. Develop effective vaccines for immunizing against the leukosis viruses.
- J. Find chemical and other therapeutic agents or hormones to control the disease.

CHARACTER OF POTENTIAL BENEFITS: The reduction or elimination of avian leukosis in poultry will greatly reduce condemnation losses in broilers and mature birds, mortality in chickens, and production losses due to morbidity. This will reduce the cost of poultry meat and eggs to the consumer. These results also may have an indirect effect on reducing losses from bovine leukemia and other malignant diseases of livestock and may contribute to a better understanding of human cancer.

MAGNITUDE OF POTENTIAL BENEFITS: It is estimated that the extra cost of production inputs from condemnation losses in broilers amount to \$23.6 million for condemnation and an additional \$5.3 million for processing and handling cost waste. Condemnation losses in mature birds amount to \$.4 million for condemnation and \$.2 million for processing and handling cost waste. Losses due to mortality are estimated at \$66.8 million and those due to morbidity at \$94 million. The total benefits from saved inputs amount to \$190.3 million. This does not include losses due to leukosis in the turkey industry.

RESEARCH EFFORT:

T F RECOMMENDATION

1972                  1977

38                  39

TITLE: *Salmonella and related infections of poultry. RPA 211-B.*

SITUATION: The genus *Salmonella* is comprised of a large group (over 1200 species) of serologically related, gram negative, nonsporulating rods. Related microorganisms of known pathogenicity to poultry include *Escherichia coli* and *Arizona paracolon*. These microorganisms are widely distributed in nature. They are primarily intestinal parasites of man, mammals, birds, and cold blooded vertebrates. Although there are apparent differences in the disease producing ability of members of the genus *Salmonella*, all species must be considered potential pathogens. These microorganisms produce widespread losses in poultry through increased mortality and morbidity along with a decreased productivity. In addition, poultry infected with these microorganisms are reservoirs of organisms for infections in man and other animals which are responsible for causing large economic losses annually.

OBJECTIVE: To determine the most effective means of detecting and eliminating *Salmonella* and related infections of poultry.

RESEARCH APPROACHES:

- A. Study the bio-ecology of the most frequently occurring serotypes of *Salmonella* and related infections.
- B. Study the host parasite interactions, including the effect of added physical, chemical and biological stress factors.
- C. Determine effective methods of preventing contamination of the poultry environment. (Conditions which prevent development of parasites, and housing that can be easily cleaned and disinfected.)
- D. Develop methods of destroying these organisms inside hatching eggs.
- E. Improve serological, cultural and identification procedures.
- F. Study the epidemiology of *Salmonellas* detected in connection with the National Poultry and Turkey Improvement Plans.

CHARACTER OF POTENTIAL BENEFITS: The elimination of *Salmonella* from poultry will increase the efficiency of production as well as increasing the wholesomeness of the product to the consumer.

MAGNITUDE OF THE POTENTIAL BENEFITS: The annual loss from these microorganisms is difficult to quantify. Factors to consider in estimating the potential magnitude of benefits include the direct effect these microorganisms have upon the poultry industry, as well as their effects upon other livestock, and man. Infection with these microorganisms results in increased mortality, morbidity, medication costs (both prophylactic and therapeutic), and reduced efficiency of production.

<u>RESEARCH EFFORT:</u>	<u>T F RECOMMENDATION</u>
<u>1972</u>	<u>1977</u>
32	39

TITLE: Respiratory diseases. RPA 211-C.

SITUATION: Respiratory diseases of poultry cause serious economic challenges to the industry. These diseases are: Newcastle disease, infectious bronchitis, Mycoplasma infections, and avian influenza. They are widely distributed throughout the world as well as in the U.S.A. The losses are due to impaired growth of poultry, decrease in feed efficiency, reduced egg production, low fertility and hatchability of eggs, death, medicinal costs, and increased labor, as well as the cost of vaccination. The annual losses due to Newcastle disease alone amount to approximately 35 million dollars. Additional significant expenses are incurred through the cost of vaccines and vaccination. Still additional, unaccountable losses come from restrictions upon exports of eggs, baby chicks, breeding stock, and dressed poultry.

Mycoplasma infections, usually caused by Mycoplasma gallisepticum, M. meleagridis and M. synoviae, result in over \$20 million losses due to reduced poultry quality, increased number of culls and condemnations at processing plants. Avian influenza affects turkeys. It is a relatively new disease in the United States and Canada. Since 1963 several isolations of Type A influenza viruses have been made from flocks that came down with a high morbidity. The turkey industry is quite concerned about the epizootiology of this disease since it may be associated with a variety of disease syndromes.

OBJECTIVE: To study the etiology, pathogenesis, epizootiology, and immunology of the above diseases and to develop methods for their prevention and eventual eradication.

RESEARCH APPROACHES:

- A. Attempt isolations of the causative agents using various available methods.
- B. Study pathogenesis of infections using fluorescent antibody technique, and organ cultures, as well as the standard histological and virological techniques.
- C. Identify and differentiate various strains of viruses for the purpose of producing effective vaccines.
- D. Study the relationship between certain strains of respiratory viruses.
- E. Evaluate and characterize various serological tests and determine their sensitivity, reliability, and correlation with immunity.

- F. Evaluate various media and media ingredients to attain optimum growth of Mycoplasma serotypes to prepare highly specific antigens.
- G. Study pathogenesis, contagiousness, and severity of these diseases under different nutritional, environmental and management conditions.
- H. Explore the role of genetic resistance to these diseases.
- I. Determine the efficacy of killed and attenuated vaccines.
- J. Explore the use of various diagnostic techniques and develop the basic information needed for differential diagnosis.

CHARACTER OF POTENTIAL BENEFITS:

- (a) The principal benefit will be the availability to the industry of improved methods of control and lowered incidence of disease resulting in more economic production.
- (b) The absence of disease agents in live poultry and poultry commodities will make them acceptable for export.

MAGNITUDE OF POTENTIAL BENEFITS: The potential savings may reach as high as \$70 million for this group of diseases.

<u>RESEARCH EFFORT:</u>	<u>T</u>	<u>F</u>	<u>RECOMMENDATION</u>
	1972		1977
	26		24

TITLE: Bluecomb in turkeys. RPA 211-D1.

SITUATION: Bluecomb disease of turkeys causes severe losses in various turkey raising areas of the United States. In 1961, 31 percent of the flock owners reported losses from bluecomb. The incidence and severity of this disease has steadily increased with the expanded and concentrated growth of the turkey industry. The economic loss to the turkey industry has been estimated to be 7 million dollars annually. The use and administration of antibiotics and other chemotherapeutic agents in attempts to control the disease, have added to the cost of this disease. Its etiology has not been determined.

OBJECTIVE: To identify and characterize the etiological agent(s) of bluecomb disease in turkeys and to study its immunogenic properties. To investigate the effect of environmental factors on the incidence of the disease. To establish a physiological basis for control by therapeutic or other preventive measures.

RESEARCH APPROACHES:

- A. Develop methods of propagation and isolation of the agent in tissue culture.
- B. Develop methods for reproducing the disease in susceptible and germ-free poultts.
- C. Purify the agent, produce specific diagnostic antigens and evaluate the value of vaccination.
- D. Determine modes of transmission and the role of mechanical, avian and mammalian hosts in dissemination of the agent(s).

CHARACTER OF POTENTIAL BENEFITS: The elimination of direct and indirect losses due to mortality (from 5-50% of the flock), retarded growth, poor growth efficiency, and the cost of drugs which are of immediate importance to the growers.

MAGNITUDE OF POTENTIAL BENEFITS: Losses to producers could be reduced by \$7 million a year.

RESEARCH EFFORT: (With D2, next page)

TITLE: Fowl cholera (avian pasteurellosis). RPA 211-D2.

SITUATION: Fowl cholera is a continuing worldwide disease that is frequently the cause of severe economic losses, particularly in the United States. The disease may occur as an acute septicemia causing high mortality, or a chronic form resulting in loss of production, condemnation or downgrading of the carcass.

There is little information available on the respiratory type of the disease. This form of the disease is becoming more important each year because of the recent methods of growing large numbers of poultry in confinement.

OBJECTIVES: To investigate the serologic, immunologic, biochemical and dissociative (loss of capsule) properties of a large number of isolates of Pasteurella multocida from turkeys. (This information is necessary to explain the variations in response to various immunization programs.) To study the pathogenesis of fowl cholera, and to develop cultural techniques and to study therapeutic agents and biologics that may be of value in the control of fowl cholera.

RESEARCH APPROACHES:

- A. Study the colonial morphology, including cultural characteristics and dissociation.
- B. Determine the antigenic relationship of the serologic and immunologic types.
- C. Evaluate therapeutic agents and methods to enhance their effectiveness.
- D. Improve biologics with proven immunogenic strains and adjuvants.
- E. Determine the pathogenesis of the disease.

CHARACTER OF POTENTIAL BENEFITS: The knowledge gained by the investigation of the above phenomena will result in higher yields of better quality poultry meat and eggs.

MAGNITUDE OF POTENTIAL BENEFITS: Estimate is unavailable.

RESEARCH EFFORT:

T F RECOMMENDATION  
(for D1 and D2 combined)  
1972              1977

TITLE: Other Diseases Affecting Poultry. RPA 211-E

SITUATION: There are numerous other diseases of economic importance affecting poultry. These diseases: (1) are of low, but of still significant, economic importance at the present time, (2) are of regional geographic importance, (3) apparently fluctuate in incidence from time to time, or (4) have potentials of causing severe economic losses at unknown future periods. Examples of such diseases are ornithosis, erysipelas, aspergillosis and other mycotic infections, staphylococcosis, gumboro disease, hemorrhagic enteritis, a group of myxovirus and paramyxovirus infections (e.g., avian influenza, duck virus enteritis) encephalitis diseases of avian wildlife and species of lesser economic importance, as well as certain exotic diseases.

OBJECTIVE:

- A. To determine the bio-ecology of the etiological agent(s) involved in these diseases.
- B. Develop methods of control and eradication of these agent(s).

RESEARCH APPROACHES:

- A. Improve methods for confirmatory diagnosis.
- B. Investigate actual incidence and economic loss from each disease.
- C. Conduct studies on causative agents to determine immunologic heterogeneity or homogeneity.
- D. Study methods of prevention through such factors as management, genetic resistance, immunologic procedures, and chemoprophylactic agents.
- E. Determine treatment methods and effectiveness of such items as the effect of nutrition and chemotherapeutic agents.
- F. Promulgate procedures to eradicate the disease.

CHARACTER OF POTENTIAL BENEFITS: Produce more wholesome and better quality poultry products at lower cost. Costly condemnations at the processing plant may be reduced. Elucidation of potential epizootiological danger of certain infectious agents, some of which may be a potential hazard to man.

MAGNITUDE OF POTENTIAL BENEFITS: Good estimates are not available.

<u>RESEARCH EFFORT: T F RECOMMENDATIONS</u>	<u>1972</u>	<u>1977</u>
	20	40

<u>RESEARCH EFFORT</u>	<u>INVENTORY</u>	<u>TF RECOMMENDATION</u>	
<u>Summary</u>	<u>1966</u>	<u>1972</u>	<u>1977</u>
211A		38	39
B		32	39
C		26	24
D		13	16
E		20	40
SAES	77	98	120
USDA	25	31	38
RPA 211 Total	102	129	158

TITLE: Control of internal parasites of poultry. RPA 212.

SITUATION: Internal parasites, such as coccidia, histomonads, and various kinds of helminths cause losses in all parts of the country and in all seasons. While losses from some parasitic diseases can be accounted for directly (death), it is recognized that insidious losses occur from decreased rate of gain as a result of subclinical infections and chronic diseases. At present, control measures must encompass costly poultry husbandry and management practices and chemotherapeutic agents. Adequate control is complicated by parasites within the same or different hosts which do not respond to the same therapeutic measures. Continued reliance on chemical treatments is undesirable because of the potential hazards of harmful residues in the meat and the possible establishment of drug-resistant parasites. In recent years, prolonged use of anticoccidial agents at prophylactic levels has led to the emergence of drug-resistant strains that frequently have a cross-resistance to one or more, old and new coccidiostats.

OBJECTIVES: To develop and standardize new therapeutic and prophylactic chemical agents with broad spectrum activity against unicellular and multicellular parasites. To evaluate, discover, develop and standardize biological controls, especially immunological methods, suitable to obviate or minimize the need for chemical control of parasites.

RESEARCH APPROACHES:

- A. Biotic relationship of parasites in poultry, in conjunction with the various husbandry and management practices used for rearing poultry.
- B. The role of game birds prevalent in poultry-rearing areas as reservoirs of parasites and their vectors.
- C. Evaluations of the efficacy and safety of new and improved chemicals used as anthelmintics and as therapeutic and prophylactic agents against coccidiosis and histomoniasis.
- D. Usefulness of antimutagenic agents as adjuvants to prevent coccidia from becoming resistant to coccidiostats and of mutagenic agents to include resistant strains to revert to the sensitive state.
- E. Develop in vitro cultivation systems for the propagation, growth, development and maintenance of parasites, which would be suitable for (1) preliminary screening of anthelmintics and coccidiostats; (2) the recovery of stages and products of the parasites for the preparation of potential prophylactic vaccines, (3) determining the ability of parasites to act as vectors of other disease agents (bacteria, viruses, and fungi); and (4) determining the effects of other disease agents on the parasites.

F. Determine the ultrastructure, cytochemistry and molecular biology of parasites.

CHARACTER OF POTENTIAL BENEFITS: Effective control measures against parasites in domestic and game birds, occupying the same agricultural areas, will result in higher yields of better quality poultry meat and eggs; removal of severe stress factors thereby making birds less susceptible to bacterial, viral and mycotic disease agents; more and healthier game birds for market and for stocking recreational areas, and better show birds for fanciers.

MAGNITUDE OF POTENTIAL BENEFITS: The losses to the poultry industry from parasites and the costs of the chemical treatments required for their control, is estimated to be \$90 million dollars per year.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>T F</u>	<u>RECOMMENDATION</u>
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	5	9	14
USDA	<u>5</u>	<u>10</u>	<u>16</u>
Total	10	19	30

TITLE: Protect poultry from toxic chemicals and other hazards. RPA 213.

SITUATION: Poultry may suffer losses in productivity from pesticide residues and radioactive pollutants which may remain on animal feed, litter, and in the poultry house. There is also some evidence that indicates mortality, morbidity and loss in productivity may result from mycotoxins and various bacterial toxins. While predators are not a serious problem to the poultry industry, the control of predators, particularly of turkeys, should receive some attention.

OBJECTIVE: To reduce or eliminate losses caused by toxic chemicals and other hazards. This includes losses due to pesticides, mycotoxins, miscellaneous bacterial toxins, and predators.

RESEARCH APPROACHES:

- A. Determine the metabolic fate of pesticides and other potentially toxic chemicals likely to be ingested by poultry.
- B. Develop management practices that minimize the use of pesticides and other chemicals that leave toxic residues, or develop management practices that would reduce the level of such residues
- C. Determine the specific mechanism of detoxification and sensitivity to toxic material of poultry.
- D. Determine the specific sites and mechanisms of poisoning, in order to learn the molecular basis of the phenomena in poultry.
- E. Develop methods of combating nuclear radiation hazards to poultry.
- F. Develop management systems that reduce or eliminate the dangers of predators.
- G. Develop management systems that eliminate the dangers of toxins developing in feed and litter.

CHARACTER OF POTENTIAL BENEFITS: Protect animal health and indirectly human health. Permit poultrymen to use safely and benefit from the use of agricultural chemicals. Reduce mortality and morbidity due to toxins. Possibly reduce public concern about air pollutants, pesticides, et cetera.

MAGNITUDE OF POTENTIAL BENEFITS: Although losses as a result of toxic chemicals and other hazards may occasionally be dramatic, the total losses due to low-grade toxicities may be of much greater economic importance. It is likely that the total losses from toxic chemicals and other hazards are substantial and have a significant impact on the poultry industry. It is not feasible to quantify the magnitude of the potential benefits.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>T F</u>	<u>RECOMMENDATION</u>
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES	2	2	3
USDA	3	4	6
Total	5	6	9

TITLE: Protect poultry from harmful effects of air pollution. RPA 214.

SITUATION: The control of ammonia and dust in poultry houses is a factor of considerable concern to producers of meat and eggs. Very little is known about their effect on the performance of poultry flocks or the role they might play in the spread of organisms which cause disease outbreaks and resulting morbidity and mortality. Since birds housed in bacteria-free environments are known to perform better and have less infection from diseases it seems that the relationship between these factors and the incidence of diseases should be thoroughly investigated. These factors may also be important to the health and comfort of caretakers or laborers.

OBJECTIVE: To study the effect of ammonia dust and other air pollutants in the environment on growth, reproduction and incidence of disease infection.

RESEARCH APPROACHES:

- A. Compare the growth rate, reproduction and disease incidence of birds housed in clean air environment with those housed in an environment polluted with dust and other air pollutants
- B. Develop methods or procedures which can be used to remove dust and other pollutants from the environment in which poultry is housed.

CHARACTER OF POTENTIAL BENEFITS: Improve performance and health of poultry flocks. Development of systems for the reduction or removal of these factors from the environment in which poultry is housed.

MAGNITUDE OF POTENTIAL BENEFITS: Increased productivity and improved disease control.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>TF RECOMMENDED</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
SAES			
USDA	—	—	—
Total	0	2	3

REPRODUCTIVE PERFORMANCE OF POULTRY RPA 310

TITLE: Lengthening period of high intensity table egg production. RPA 310-A

SITUATION: Currently White Leghorn are kept in the laying houses for 12 to 15 months, then replaced with young pullets. "Spent" hens bring ridiculously low prices (\$0.02 to \$0.09 per pound). Ready to lay pullets cost \$1.60 to \$1.80 each and lay 18 to 20 dozen eggs each. The "hen" cost per dozen thus is \$0.08 to \$0.10 per dozen. Two possible ways of reducing "hen" cost in commercial egg production include seeking greater production intensity during the 12 to 14 months of egg laying, or extending the period during which high intensity production of high quality eggs occurs. The first alternative may be very difficult to accomplish. Extension of the useful production cycle would appear to be entirely feasible, in fact, breeding of present day stock has involved this phenomenon. Resting the hen with a forced molt has been tried as a method of securing a second year of egg production from hens. However, the cost of maintaining the hens during the "rest" is nearly as much as the cost of new pullets and egg production is never very high the second year.

OBJECTIVE: To develop strains of table egg production hens that will lay at a rate of 75 percent or more for a period of at least 24 months.

RESEARCH APPROACHES:

- A. Base selection of breeders on 2 years or more of production.
- B. Determine if hens can be selected that molt only gradually, if at all, while continuing to lay.
- C. Study the effect of a strictly controlled "nonseasonal" environment on egg production.
- D. Study the role of disease load on persistency of production.
- E. Study the changes in physiological or biochemical characteristics of oviducal or other body tissues associated with lower egg quality during senescence of birds.

CHARACTER OF POTENTIAL BENEFITS: Improved table egg production economy would result from longer use time of a given flock of birds. Egg quality may be improved through selection for shell strength over a longer period of time.

MAGNITUDE OF POTENTIAL BENEFITS: A potential decrease of \$0.04 per dozen on the 5 billion dozens of table eggs produced each year would result in a savings of \$200 million.

RESEARCH EFFORT:

TF RECOMMENDATION

1972 - 11

1977 - 14

TITLE: Improved egg production of broiler breeder hens and turkeys.  
RPA 310-B.

SITUATION: Reproduction in meat strains of birds, either chickens or turkeys, presents unique problems. To be economical meat birds must grow very rapidly and must have a high proportion of meat to bone. These characteristics are generally biologically antagonistic to high egg production. Rate of growth is associated with adult body size and as a result of selection for rate of growth in broilers, the size of adults used for egg production has increased until it is common for the hens to weigh 8 pounds. Combined with this rapid growth and large size is a marked tendency for the hens to become too fat. The low egg production of the broiler hen combined with the high feed consumption of such large birds results in relatively expensive hatching eggs. Broiler breeders not only lay at a much lower rate than Leg-horns but for a much shorter period and have a lower fertility rate. It is common for them to be sold after only 9 months or less of production. During this time, only 100 to 120 usable eggs will have been produced. The problems associated with reproduction in turkeys are much the same as with broiler breeders with the added responsibility of the turkey breeder to produce a turkey with extremely broad breast. Broiler breeders have partly overcome the unfavorable economics of the genetic association of desired traits by developing male and female lines that are crossed for the production of commercial chicks.

OBJECTIVE: To improve the egg production of broiler and turkey hens without loss of current growth rate or conformation.

RESEARCH APPROACHES:

- A. Determine the genetic relationship between the factors of egg production and growth rate and between egg production factors and conformation.
- B. Compare index selection and tandem selection as methods of reaching desired objective when antagonistic traits are involved.
- C. Select for percentage of adult weight reached at an early age.
- D. Determine whether or not a progeny-test selection program can result in improvement among current strains.
- E. Study the need for special nutritional, lighting, and other environmental requirements for meat birds for maximizing egg production.

CHARACTER OF POTENTIAL BENEFITS: Reduction of cost of broiler chicks from \$0.13 to \$0.10, and turkey poults from \$0.85 to \$0.75.

MAGNITUDE OF POTENTIAL BENEFITS: Cost of producing 2.75 billion broilers annually reduced \$0.03 would save \$82 million, and 100 million turkeys reduced \$0.10 would save \$10 million.

<u>RESEARCH EFFORT:</u>	T F	RECOMMENDATION
	<u>1972</u>	<u>1977</u>
	12	14

TITLE: Improving hatch of chickens and turkeys from fertile eggs. RPA 310-C.

SITUATION: The successful hatching of a healthy chick or poult from the fertile egg is the culmination of many complicated processes. Currently we waste 15 to 25 percent of all eggs set. The yield of chickens per 100 eggs set varies somewhat with the breed and strain, Leghorns being somewhat higher than the broiler breeds. Turkey hatchability is highly variable with season but seldom is more than 80 percent, with late season hatches being considerably lower. The distinction between infertility and very early embryo mortality is difficult to make; however, enough information is available to show that many fertilized eggs fail to hatch. If the mortality is very early, it is probably the result of factors other than the physical conditions within the incubator. Later mortality may be the result of either an inherited weakness of the embryo or faulty incubation conditions. The latter might be improper temperature or humidity or air movements, or a lack of uniformity of conditions throughout the chamber. Contaminated dust as a result of improper cleaning, which in turn might also be the result of poor design, can result in poor hatches and/or poor quality chicks. Since the general adoption of the mammoth incubator by the poultry industry in the 1930's, there has been a minimum of incubation research by anyone other than the incubator manufacturing companies. We seem to have the attitude that we know all there is to know about the subject.

OBJECTIVE: To determine reasons why 15 to 25 percent of the fertile chicken or turkey eggs set fail to produce normal healthy chicks or poult, and to recommend improved procedures that will reduce eggs failing to hatch by one-half.

RESEARCH APPROACHES:

- A. Determine the percentage of infertility and early dead embryos under commercial production conditions and the reasons for embryonic deaths.
- B. Make a detailed study of conditions within commercial incubators. This would include temperature, humidity, carbon dioxide content and air movement, and the uniformity of conditions within the machine.
- C. Instigate further studies on use of different oxygen and carbon dioxide mixtures, and their interrelationship to various temperatures and humidities, in improving hatchability.

- D. Study the genetic relationship between hatchability and egg production, growth rate, and conformation. It seems reasonable to assume that in turkeys there may well be a negative relationship between the extreme broad breast condition and hatchability.
- E. Restudy the area of hatching egg holding conditions. Strains have changed considerably since first recommendations were made. Inert gases may improve the holding environment.
- F. Genetic lethals may be carried by chicken and poult populations and should be investigated.

CHARACTER OF POTENTIAL BENEFITS: Reduction by one-half of the fertile chicken and turkey eggs that fail to produce salable chicks and poult.

MAGNITUDE OF POTENTIAL BENEFITS: Approximately \$410 million are spent for poult and chicks annually. About 10 percent less eggs would need to be set and incubation costs would be proportionately less. The total reduction in cost of poult and chicks would be close to 10 percent of \$410 million or \$41 million.

RESEARCH EFFORT:

TF RECOMMENDATION

<u>1972</u>	<u>1977</u>
11	10

TITLE: Improved artificial insemination techniques and semen preservation of avian species. RPA 310-D.

SITUATION: Artificial insemination has been completely successful only in the bovine species. This is probably because bovine semen appears to be more easily stored than semen of other species and it is the only farm animal semen which can be successfully frozen for practical use. Unfortunately, research to date indicates that there is a high degree of species specificity in the holding conditions and diluents adaptable to semen preservation. In spite of our lack of adequate techniques for successfully holding turkey semen for even short periods of time, artificial insemination is regularly employed in the production of most of the commercially-produced turkeys in the United States. Because of the conformation of the birds and the lack of selection pressure for good reproduction, most commercial strains of turkeys would have an extremely low reproductive rate if only mated naturally. The possible benefit to the geneticists if all semens could be preserved in the frozen state indefinitely are obvious. With cage operations becoming increasingly popular, it is conceivable that artificial insemination can be an important tool in the production of chickens, particularly at the primary breeder level, if adequate techniques for semen preservation are available.

OBJECTIVE: To improve the techniques of artificial insemination in birds.

RESEARCH APPROACHES:

- A. More basic research on characteristics of avian semen.
- B. Instigate further research on the in vitro methods for preserving fowl semen in an unfrozen condition. This will involve the study of various diluents, temperatures, and combinations of the two.
- C. To develop techniques for the successful freezing of avian spermatozoa.
- D. Develop improved methods of automatically measuring and inseminating avian semen.
- E. Develop in vitro criteria to predict the fertilizing capacity of semen prior to its use.
- F. Determine if artificial insemination in any way is associated with disease transmission.

CHARACTER OF POTENTIAL BENEFITS: Improved fertility and reduced male costs.

MAGNITUDE OF POTENTIAL BENEFITS: A possible reduction of 2 percent in the cost of producing 85 million dollars worth of poult's, or \$1.7 million annually.

RESEARCH EFFORT:

	T	F	RECOMMENDATION
	<u>1972</u>		<u>1977</u>
	6		7

TITLE: Management for maximum fertility. RPA 310-E.

SITUATION: There are many management factors which are thought to affect fertility rate, yet on which very limited information is available due to the difficulty of doing research on such an applied problem. For example, it is generally recommended that there be 6 to 8 males per 100 females, yet often as few as 3 males per 100 females have given excellent fertility. Pedigree records show that some females never produce fertile eggs while others have perfect fertility. Research in the area of animal behavior indicates that perhaps some of the infertility which is witnessed may be associated with unusual behavior patterns. The physical environment in which birds are housed may be another factor affecting fertility. Light has long been known to be a strong regulator of reproductive activity. Generally speaking, the highest fertility occurs shortly after or about the time of peak egg production. Fertility of the males usually drops off markedly as the hot seasons of the year approach. Since we secure only 75 to 85 chicks per 100 eggs set, and since many of the eggs that do not hatch are found to be infertile, continued investigations in this area should prove fruitful.

OBJECTIVE: To improve fertility of chicken and turkey eggs through improved management techniques.

RESEARCH APPROACHES:

- A. Study the mating behavior of a series of males in broiler breeder pens. Correlate mating activity and vent condition to determine if the vent can really be used as an indicator of mating activity.
- B. Determine reproductive activity of individual males over periods of one year or more to determine patterns of activity.
- C. Estimate the rate of senescence of males under different environmental conditions.
- D. Restudy the economics of replacing old males with younger ones during the breeding season.
- E. Evaluate the influence of "disease load" on fertility.
- F. Study effect of pen size and feeding arrangements on fertility.
- G. Study effect of such practices as debeaking, dubbing, toe clipping, etc.

CHARACTER OF POTENTIAL BENEFITS: Improve fertility of hatching eggs.

MAGNITUDE OF POTENTIAL BENEFITS: Potential 5 percent decrease in cost of producing \$400 million worth of chicks and poultts for a total of \$20 million annually.

RESEARCH EFFORT:

	<u>T</u>	<u>F</u>	<u>RECOMMENDATION</u>
	<u>1972</u>		<u>1977</u>
	7		9

TITLE: Control of sex in avian species. RPA 310-F.

SITUATION: Man has long dreamed of the possibility of controlling the sex of his own offspring as well as that of animals that are economically important to him. If sex of poultry could be controlled, it would add immeasurably to the efficiency of reproduction. In the egg-laying strains, most of the males are a complete loss and are disposed of immediately after hatching. A loss is not only incurred in the production of all the unwanted males, but an additional loss is incurred in the sexing operation necessary to separate the two sexes. In the meat-production strains, exactly the opposite situation occurs. The males grow somewhat more rapidly and therefore make more efficient gains than do the females. There is a large sexual dimorphism among turkeys, the tom turkey being roughly 50 percent larger than the female. This problem admittedly will be most difficult to solve, particularly in the avian species, since it is the female sex which carries the mechanism for sexual determination. The economic potential of the work, though, would indicate that research should be under way in the area.

OBJECTIVE: To develop methods for producing all of the desired sex within chickens and turkeys.

RESEARCH APPROACHES:

- A. Study effect of low physiological levels of exogenous male and female sex hormones administered to hens on sex ratios.
- B. Determine if some males and females or matings do indeed produce sex ratios varying from normal. If such individuals are identified, their physiological differences will be studied.
- C. Study effect of treating undifferentiated embryos with exogenous steroid hormones.
- D. Determine if physical environment of parents in any way relates to sex ratio of offspring.
- E. Develop ways to separate eggs that will hatch males from those that will hatch females.
- F. Initiate a selection experiment based on divergent sex ratios of families.

CHARACTER OF POTENTIAL BENEFITS: Reduce cost of pullet egg-laying chicks by 50 percent, and decrease the cost of producing broiler and turkey meat by 2.0 percent.

MAGNITUDE OF POTENTIAL BENEFITS: A savings of \$0.007 per dozen in egg production costs would result in annual saving of \$28 million. Broiler and turkey meat cost might be lowered by 2.0 percent resulting in a \$36 million saving.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>TF RECOMMENDATION</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
		3	6
<u>Summary</u>			
RPA 310 A		11	14
B		12	14
C		11	10
D		6	7
E		7	9
F		3	6
SAES	33	44	52
USDA	4	6	8
RPA 310 Total	37	50	60

FEED EFFICIENCY IN PRODUCTION OF MEAT AND EGGS RPA 311

TITLE: Improve digestion and metabolism of feed by poultry. RPA 311-A

SITUATION: Poultry are relatively efficient utilizers of feed. However, there is no reason why further improvement in utilization of our existing feeds cannot be attained. Basic information is required to obtain this improvement. The efficiency of feed utilization is dependent on the breakdown of feedstuffs into various nutrients, absorption of the nutrients and the metabolic processes whereby they are converted to energy and tissue. There is practically no quantitative information on the factors which may influence breakdown and absorption such as physical characteristics of feed ingredients, rate of passage through the digestive system, effect of processing (heating, treatment with water, treatment with enzymes, pelleting, flaking), digestive enzyme systems and hormones, and interaction of nutrients. Information is also urgently needed on how and to what extent metabolism is affected by enzyme systems and hormones, ambient temperature and other environmental factors. Quantitative data are needed in all these areas for commonly used feedstuffs to permit the formulation of diets for maximum feed efficiency.

OBJECTIVE: Improve digestion and metabolism by obtaining basic information of avian digestion and metabolism and the various dietary, genetic and hormonal factors which affect them.

RESEARCH APPROACHES:

- A. Determine effect of physical characteristics of feedstuffs on rate of passage through digestive system.
- B. Determine effect of processing on absorption and utilization.
- C. Determine effect of treatment with enzymes on absorption.
- D. Determine effect of enzyme systems, hormones and environment on digestion and metabolism.
- E. Select birds for highly efficient digestion and metabolism.

CHARACTER OF POTENTIAL BENEFITS: Improve digestion and metabolism with a resulting increased efficiency of feed utilization including lower feed costs per dozen of eggs and per pound of meat.

MAGNITUDE OF POTENTIAL BENEFITS: A ten percent increase in efficiency would not be unreasonable. This would result in a saving of approximately \$100 million per year.

RESEARCH EFFORT:

TF RECOMMENDATION

1972 - 30

1977 - 33

TITLE: Factors that will increase the longevity and productive life of fowl. RPA 311-B

SITUATION: In commercial practice the majority of broiler breeders are replaced at around 15 months of age and egg production stock at 18 months. This means that a hen has a productive life of less than 12 months. The production of pullets to laying age is costly, due to chick cost, labor, rearing facilities, etc. To increase longevity, a coordinated study involving all disciplines of poultry production research is necessary. Geneticists must develop strains with the potential for a long productive period. Physiologists must determine the physiological processes necessary and nutritionists must learn how to feed birds for a long productive life. For example, very few attempts have been made to refine the nutritional requirement of the laying hen. Most laying flocks are fed essentially the same type of diet throughout their production period. This results in an oversupply of nutrients in some instances and an undersupply in others. Accurate data are needed on the nutritional requirements for optimum performance of the commonly used genetic strains at various ages, different levels of production and under different environmental conditions.

OBJECTIVE: Determine means for extending the period of high production, as well as high fertility and hatchability, in older birds.

RESEARCH APPROACHES:

- A. Determine the nutritional requirements of various strains of birds for optimum performance, by age, level of production and kind of environment.
- B. Determine the nutritive combinations and level for maximum performance of older birds with respect to: egg production, fertility, hatchability, egg quality, and least cost of feed per unit of egg.

CHARACTER OF POTENTIAL BENEFITS: Lower feed cost per dozen of eggs or pound of meat produced.

MAGNITUDE OF POTENTIAL BENEFITS: If the productive period of hens can be increased from the present 10 to 15 months to two years, the benefits would be worth well over \$100 million.

RESEARCH EFFORT:

TF RECOMMENDATION

1972

1977

24

25

TITLE: Reduced nutritional requirements of birds for meat and egg production  
RPA 311-C

SITUATION: Most poultry breeders have given very little emphasis to the nutritional requirements in their breeding programs. In some cases strains have been reared on diets that were as nutritionally adequate as it was possible to make them. Consequently, when birds reared in this manner are subjected to nutritional stresses, they give poor performance. Contrary to this, a few breeders subject the birds to severe nutritional stress from which only the hardiest birds survive. However, in both nutritional approaches, the possibility of breeding birds with lower nutritional requirements has been missed. With these types of approach, it is impossible to estimate the number of strains of birds which possessed requirements less than those furnished by the diet when selection was made. Also, it is equally impossible to estimate how many superior strains have been discarded because the diet did not contain adequate nutrients. In order to improve feed efficiency extensive investigations are needed, involving both the geneticist and nutritionist, to attempt to develop strains with lower nutritional requirements for energy and amino acids.

OBJECTIVE: Identify birds with highly efficient feed utilization potential, including low nutritive requirements.

RESEARCH APPROACHES:

- A. Determine nutritive requirements of highly diverse strains of birds.
- B. Select populations of birds differing in nutritive requirements, especially for energy and amino acids.
- C. Determine the possibility of increasing growth and thus feed efficiency by crossing strains of chickens, turkeys, geese, ducks, and other fowl.
- D. Select birds capable of utilizing low cost feeds efficiently.

CHARACTER OF POTENTIAL BENEFITS: Lower feed requirement per unit of egg or meat produced; lower cost per unit of feed consumed; increased growth rate.

MAGNITUDE OF POTENTIAL BENEFITS: Difficult to evaluate since no one knows what the limit is. Based on the past improvement, a saving of \$50 million per year should not be unreasonable.

RESEARCH EFFORT:

TF RECOMMENDATION

<u>1972</u>	<u>1977</u>
<u>50</u>	<u>50</u>

TITLE: Alternate sources of nutrients, including synthetic materials.  
RPA 311-D

SITUATION: Poultry competes directly with the human for its dietary requirements of energy and protein. Cereal grains which are the sources of energy for poultry and equally nutritive for humans, and oil seeds and animal by-products when further processed are suitable for human food. Since animal protein, particularly poultry meat and eggs, are far superior to vegetable protein in their amino acid composition, it is imperative to have them in adequate supply in order to maintain our present nutritional level. In view of the diminishing world food supply, it is necessary to seek new sources of protein and energy that are not suitable or desirable for human food. Synthetic sources of these nutrients are desirable and comprehensive investigations should be made for such sources, such as the possible substitution of glycols for carbohydrates. Natural sources which could be processed into adequate feedstuffs should also be investigated. Processes whereby nonprotein nitrogen could be converted into amino nitrogen should be studied.

OBJECTIVE: Find alternate sources of nutrients and evaluate synthetic substitutes.

RESEARCH APPROACHES:

- A. Develop efficient method for converting nonprotein nitrogen into amino nitrogen by microorganisms.
- B. Determine a satisfactory supplementation of poor quality protein with synthetic amino acids.
- C. Identify sources of energy other than carbohydrates from cereal grains.

CHARACTER OF POTENTIAL BENEFITS: Use of currently low quality feed ingredients, and use of feeds not presently used as a poultry feed.

MAGNITUDE OF POTENTIAL BENEFITS: Difficult to evaluate, but in case of a nutrient shortage it would allow the formulation of an adequate diet.

<u>RESEARCH EFFORT:</u>	<u>T F RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	8	9

TITLE: Rapid determination of biological value and chemical composition of feed ingredients. RPA 311-E.

SITUATION: One of the most serious problems in the formulation of diets for optimum feed efficiency is lack of knowledge concerning the exact biological value of the particular ingredients that go into any batch of mixed feed. Individual feedstuffs vary considerably in chemical composition according to variety, soils, and other factors. For example, corn may vary from 7 to 9 percent in protein. Oil seeds and other processed proteins may vary in biological availability of amino acids as result of processing. Average values for protein, amino acid and energy values of feedstuffs are used for diet formulation because available analytical methods are too cumbersome and time consuming to be of value to the feed manufacturer. There is a great need for studies on methods which will yield accurate analytical results in a much shorter time. Since biological values may be lower than the chemical values emphasis should be placed on rapid methods for biological evaluation of feedstuffs. Studies on methods for amino acid and energy values should have priority since the relationship between these nutrients is very sensitive in maintaining feed efficiency. Furthermore, protein and energy sources account for more than 90% of the cost of a poultry diet.

OBJECTIVE: Determine composition and biological availability of feeds, especially those which are major components of the diet.

RESEARCH APPROACHES:

- A. Develop rapid methods for amino acid analysis.
- B. Develop rapid methods for amino acid availability.
- C. Develop rapid method for determination of metabolizable energy.
- D. Develop rapid method for determining other nutrients in feedstuffs.

CHARACTER OF POTENTIAL BENEFITS: Lower feed cost per unit of eggs and meat, because diets could be prepared which supply the exact nutrients required by birds for maximum performance.

MAGNITUDE OF POTENTIAL BENEFITS: Based on work at several of the experiment stations, it is possible to reduce total feed requirements by as much as 30 percent.

RESEARCH EFFORT:

T F RECOMMENDATION

1972

1977

11

12

TITLE: Antibiotics and nonnutritive feed additives. RPA 311-F

SITUATION: Advances in genetics and nutrition, the concentration of poultry in increasingly large units, together with changes in management systems, necessitates a reevaluation of the efficacy of nonnutritive feed additions, particularly antibiotics, in poultry production. Antibiotics have been used in poultry rations for about 20 years. There were extensive investigations during the early period of use, but with present day routine additions to poultry diets, there is very little work concerned with their effectiveness. During the era of intensive study, widely different experimental results in growth rate and feed efficiency were obtained with different antibiotics at various dietary levels. Results of from zero to 20 percent improvement have been reported, and it is estimated that on the average a 5-percent improvement was obtained. Information is urgently needed on the sustained performance of the older antibiotics and the effectiveness of the more recent ones. This calls for comprehensive investigations in the laboratory and under field trial conditions. This type of work is needed because the poultry industry needs some measure of the economic gain resulting from the use of antibiotics. The producer has to balance the cost of the antibiotics, the risk of residual antibiotics being present in the product, and the possible increase in antibiotic resistant organisms against the actual benefit of increased growth rate and feed efficiency. Furthermore, the fact that antibiotics do give significant gains in performance under some conditions and at other times produce no measurable benefit, call for comprehensive investigation of the factors that affect response. The variation in response may be concerned with type of diet, kind and level of antibiotic fed, environmental conditions, class of poultry, age of birds and disease level.

OBJECTIVE: Determine beneficial effects of antibiotics and nonnutritive feed additives to poultry.

RESEARCH APPROACHES:

- A. Factors responsible for variation in response to antibiotics.
- B. Studies on the economic benefits of commonly used antibiotics both in the laboratory and under field conditions.
- C. Evaluate new antibiotics for sustained performance.
- D. Identify beneficial nonnutritive feed additives.

CHARACTER OF POTENTIAL BENEFITS: Improvement in general health of the birds, as well as an increase in rate of gain, increased egg production, improved feed utilization and lower mortality and morbidity.

MAGNITUDE OF POTENTIAL BENEFITS: Approximately a 5 percent increase in rate of gain and efficiency of feed utilization.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	11	12

TITLE: Providing environmental conditions for improvement in efficiency of feed utilization. RPA 311G.

SITUATION: Feed represents the largest single item of cost in producing poultry meat and eggs. Although improvements in the conversion of feed to meat and eggs continue to be made through better nutrition and breeding, it is known that environmental conditions have a significant effect on the efficiency with which feed is converted to meat and eggs. For example, extremes in temperature affect the amount of feed consumed and energy that is required to maintain body temperature and thus play important roles in determining the amount of energy that is available for maintenance, growth and reproduction. Therefore, it is important to obtain basic information concerning optimum environmental conditions for broilers, layers and turkeys that will make possible the most efficient conversion of feed to meat and eggs.

OBJECTIVES:

- A. To determine the relationship between the various environmental factors and efficiency of feed utilization.
- B. To determine the optimum environmental conditions for each of these factors which must be provided in order to obtain maximum feed conversion.

RESEARCH APPROACHES:

- A. Evaluate the relative importance of the various environmental factors on feed utilization.
- B. Determine the optimum conditions for each of the most important environmental factors that will provide the best feed conversion for each class of poultry.

CHARACTER OF POTENTIAL BENEFITS: Reduce cost of production of meat and eggs.

MAGNITUDE OF POTENTIAL BENEFITS: A 10 percent improvement in conversion of feed to meat in broilers is valued at \$90 million per year.

<u>RESEARCH EFFORT</u>	<u>INVENTORY</u>	<u>T F RECOMMENDATION</u>	
		<u>1966</u>	<u>1972</u>
			5
			5
<u>Summary</u>			
RPA 311 A		30	33
B		24	25
C		50	50
D		8	9
E		11	12
F		11	12
G		5	5
SAES	<u>125</u>	130	<u>137</u>
USDA	8	9	9
RPA 311 Total	133	139	146

## ENVIRONMENTAL STRESS IN PRODUCTION OF POULTRY RPA 312

TITLE: Environmental conditions for optimum productivity. RPA 312-A.

SITUATION: Extremes in environmental factors (such as temperature, humidity, air movement, sound, light and crowding) frequently result in decreased growth and reproduction, reduced disease resistance, and behavioral responses that lead to reduced productivity or even death. It is estimated that more than 100 million square feet of poultry housing will be constructed yearly to replace existing housing and to provide for needed expansion in broiler and turkey production. The cost of this housing may approach \$200 million per year. The trend is toward more completely environmentally controlled conditions. However, basic information on the environmental requirements for optimum productivity is still lacking. Much of the poultry housing being built today is designed to specifications that are largely determined by opinion. No doubt construction costs could be reduced or at least many mistakes eliminated and still meet optimum requirements.

OBJECTIVE:

- A. To determine the requirements of poultry for space, temperature, humidity, air movement, light and other physical environmental conditions.
- B. To provide adequate information on design of structures, controls and equipment needed to provide optimum environmental conditions.

RESEARCH APPROACHES:

- A. Determine the effects of environmental factors on physiological functions and behavioral responses and their relationship to performance.
- B. Establish the optimum requirements of poultry for environmental factors such as space, light, temperature, humidity, air movement, etc.
- C. Study the relationship between the various environmental factors and how these are associated with stress and its effect on productivity.
- D. Develop housing that will provide environmental conditions to satisfy the requirements of various classes of poultry for maximum productivity.
- E. Investigate alternative methods of housing poultry to meet their physiological requirements for maximum performance.

- F. Develop equipment and controls that will make it possible to operate poultry housing to provide optimum environmental conditions.
- G. Develop and evaluate equipment used in poultry houses that will make it possible to more completely automate the production of meat and eggs.

CHARACTER OF POTENTIAL BENEFITS: Increased productivity, improved quality of product, lower mortality, and lower costs of production including capital investment.

MAGNITUDE OF POTENTIAL BENEFITS: It is reasonable to expect that housing costs could be reduced 10%, if we knew the specific requirements of poultry for optimum productivity. This would result in an annual saving of \$20 million. In addition, we must assume that as much as 75% of the poultry meat and eggs produced come from poultry suffering some loss in efficiency due to less than optimum environmental conditions. Even a 5% improvement in productivity would result in reducing production inputs by more than \$100 million a year.

<u>RESEARCH EFFORT:</u>	<u>T F RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	30	36

TITLE: Adaptability to environmental variation. RPA 312-B

SITUATION: Variation in environmental conditions are known to affect the performance of stocks of poultry. Some stocks perform well under a certain set of environmental conditions while others perform badly and visa versa. These genotype-environment interactions are of concern to poultry breeders as well as producers because of their effect on growth, reproduction and disease control. The systems of management for the production of broilers, turkeys and eggs are continually changing in order to reduce production costs. An example is the use of cages to house commercial layers instead of the traditional floor method. Some stocks perform better than others when housed in cages, and this is undoubtedly due to differences in ability to adapt to stress conditions provided by this system of management of layers. Similarly, for broilers and turkeys new management systems may be developed that will make it possible to reduce production costs. It is conceivable that in the future poultry meat production will shift from the floor to cages in which the birds will be reared and moved to the processing plant without being removed from the cages. Under this type of management system it is quite obvious that the birds will be subjected to stress conditions that are not known today. Shrinkage and quality loss during transit are major problems in getting poultry meat and eggs from farm to processing plant. Management and handling systems prior to the time trucks leave the farm contribute to these losses.

OBJECTIVE: To improve the adaptability of poultry to environmental stresses through breeding and management.

RESEARCH APPROACHES:

- A. Investigate the importance of environmental factors on the performance of genetic stocks.
- B. Determine the total amount of variance due to genotype environment interaction for the various production traits.
- C. Identify selection criteria for the development of stocks that adapt for maximum performance under different environmental conditions.
- D. Determine the stress condition provided by different systems of management
- E. Evaluate the ability of poultry to adapt to the stress conditions provided by specific management systems.

- F. Relate adaptability to various sets of stress conditions to the development of new systems of management.
- G. Determine the conditions by which shrinkage and quality loss are caused.
- H. Develop new management and handling systems that result in the minimum amount of shrinkage and quality loss.
- I. Evaluate these systems in terms of reduction of shrinkage and quality loss and relate to cost and returns.

CHARACTER OF POTENTIAL BENEFITS: Reduced production costs and improved growth, reproduction and disease control methods. Minimize losses from shrinkage and quality loss of poultry and eggs in transit.

MAGNITUDE OF POTENTIAL BENEFITS: We really don't have good evidence on the amount of improvement in productivity that might result. However, even a 2 percent change could result in reducing inputs by \$50 to \$60 million a year. Currently 20% of all birds processed are downgraded for carcass bruises and damages between the time they are caught on the farm and graded at the processing plant. Shrinkage losses affect all poultry and eggs in transit.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>T F RECOMMENDATION</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
		19	24
<u>Summary</u>			
RPA 312 A		36	36
B		19	24
SAES	29	42	51
USDA	5	7	9
RPA 312 Total	34	49	60

## IMPROVED POULTRY PRODUCTION MANAGEMENT SYSTEMS RPA 313

TITLE: Identifying breeding systems for efficient production of poultry and eggs. RPA 313-A.

SITUATION: In recent years, great progress has been made in the efficient production of poultry and eggs. Much of this progress can be ascribed to improved breeding systems. Research on breeding systems has been so successful that the poultry industry no longer looks to the U.S.D.A. or the State Agricultural Experiment Stations to produce new breeds and varieties for the economic production of poultry meat and eggs. Commercial poultry breeders have been alert to new research findings and have rapidly put them into effect in their own breeding programs. It is estimated that almost 100 percent of all broilers now produced are cross bred and about 95 percent of table eggs are produced by crossbred or strain-crossed hens. Yet, we are still far away from the ultimate efficient production of chicken or turkey meat or of table eggs. Ample evidence exists to show that a great amount of genetic variation remains to be tapped in poultry populations. However, problems have been encountered in extending performance improvement beyond the plateaus quickly reached.

OBJECTIVE: To identify breeding systems and methodology that will permit full attainment of the biological potentials of poultry meat and egg production.

### RESEARCH APPROACHES:

- A. Test theoretical genetic models to fill gaps in our knowledge of genetic variation.
- B. Determine methods for breaking through plateaus of performance.
- C. Investigate ways of counteracting undesirable correlated responses which reduce reproductive capacity and viability.
- D. Explore selection in finite populations under several genetic models by using computer simulation.
- E. Adapt available techniques for assaying various blood and other body fluid enzymes to use with avian materials.
- F. Using above techniques, compare strains that show marked differences in various economic characters.
- G. Continue efforts to determine possible relationships between blood groups and important economic characters.
- H. Search for other easily identifiable anatomical or physiological markers that may be linked genetically with economic traits.

CHARACTER OF POTENTIAL BENEFITS: Increase efficiency of production and reduce costs by obtaining greater performance per bird.

MAGNITUDE OF POTENTIAL BENEFITS: Poultry and poultry products contributed more than \$4.1 billion to cash farm income in 1966 with \$2.1 billion from eggs, \$1.5 from broilers and chickens and \$0.5 from turkeys and other poultry. From 1945 to 1959 egg production per layer increased from 152 to 207, an average of 3 2/3 eggs per layer per year. From 1960 to 1966 the increase has been less than 1 2/3 eggs per layer per year. If 2 more eggs per layer per year could be produced, annual income would increase \$18 million. Broiler and turkey production would be improved proportionately.

<u>RESEARCH EFFORT:</u>	<u>T F RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	16	17

TITLE: Developing optimum systems of management of poultry flocks.  
RPA 313-B.

SITUATION: Poultry production has become more and more specialized. Turkey production, broiler production and table egg production have fewer and fewer operations in common. The electronic computer has been applied to feed formulation, payroll records and flock records. The computer has great potential for helping to schedule flock replacements and to plan operations annually.

OBJECTIVE: To develop systems of management of poultry flocks of optimum efficiency.

RESEARCH APPROACHES:

- A. Appraise the relative profitability of specialized poultry farms compared with poultry production in combination with other farm enterprises.
- B. Evaluate various sizes of poultry enterprises, including management-skill requirements and risks.
- C. Study comparative investments and return from equipment for grinding and mixing feed, equipment for preparing eggs and poultry meat for market, and buildings and equipment designed to save labor and improve performance.

CHARACTER OF POTENTIAL BENEFITS: It is estimated that total farm operating expenses for egg producing farms amounted to \$1.6 billion in 1966. For broiler and turkey farms the expenses were about \$1.0 billion. If costs of production could be reduced only 1 percent through improved management systems, the savings to poultry would amount to \$26 million.

<u>RESEARCH EFFORT:</u>	<u>T F</u>	<u>RECOMMENDATION</u>
	<u>1972</u>	<u>1977</u>
	3	5

TITLE: Developing more efficient methods of poultry waste collection, removal and disposal. RPA 313-C.

SITUATION: In the past, poultry waste was spread on the land and was an important source of fertilizer. However, poultry waste is becoming more of a problem in many areas because of the concentrated nature of modern poultry operations. Often the farm land adjacent to a large poultry operation is too limited to effectively utilize the large volume of waste produced. Furthermore, when waste is spread on frozen ground in the winter, it does not decompose rapidly and becomes a public health hazard in rivers following spring thaws. To combat the problem, attempts are being made to destroy the poultry waste in lagoons and dumps. However, poultry waste contains materials of value. It should not be destroyed. The utilization of poultry waste should be handled under RPA 901. In RPA 313 we are concerned with the collection, storage and removal of the material prior to utilization.

OBJECTIVE: To develop more efficient methods of collecting, storing, removing and disposing of poultry wastes.

RESEARCH APPROACHES:

- A. Investigate methods for using the methane in poultry manure to remove the moisture.
- B. Study feasibility of central processing stations such as those used for poultry offal.
- C. Continue to improve methods of transporting waste from the poultry house to storage or disposal facilities.
- D. Investigate genetic and nutritional factors influencing the amount and type of waste produced.
- E. Evaluate types of litter and study the possibility of reuse systems.

CHARACTER OF RESEARCH BENEFITS: Reduce the fly and odor problem and improve methods of storing waste and transporting it from the poultry houses.

MAGNITUDE OF POTENTIAL BENEFITS: Magnitude of benefits under RPA 313 will be measured more in terms of public relations than in increased profits or savings. Increased profits and savings from utilization of poultry wastes should be discussed under RPA 901.

RESEARCH EFFORT:

T F RECOMMENDAT

1972 - 9      1977 - 12

TITLE: Developing greater efficiency of labor and equipment. RPA 313-D.

SITUATION: Many advancements have been made in automating poultry production. We have automatic feeders, automatic waterers and automatic belts for moving eggs from the laying house to the egg collecting room. However, much more can be done to do the job at lower cost while maintaining better quality. Removal of waste from poultry houses is still a messy, distasteful chore. Catching broilers and turkeys prior to transporting them to processing plants still requires hand labor. Artificial insemination of turkeys has become a highly successful practice but is still a hand operation. Some of these procedures require a certain amount of manual dexterity but more mechanization could be built in.

OBJECTIVE: To develop systems and equipment to reduce labor and drudgery in poultry production.

RESEARCH APPROACHES:

- A. Examine poultry house layouts to determine shortest travel routes for necessary farm chores.
- B. Re-examine space arrangements so that less space is used for young birds than when they are older and larger.
- C. Design poultry houses adapted more to poultry than to humans who do less work in them as automation progresses.
- D. Design equipment that reduces labor and drudgery.

CHARACTER OF POTENTIAL BENEFITS: Reduced labor costs and more satisfactory type of work for labor force.

MAGNITUDE OF POTENTIAL BENEFITS: Total man hours of labor for poultry has been declining since 1950 at a compound rate in excess of 5%. Research should be able to maintain this rate. It is estimated that 440 million man-hours were used by poultry farms in 1966. Thus, more than 20 million man-hours could be saved per year for the next few years. At the minimum wage rate of \$1.60, this labor input released for other industry would have a value of at least \$32 million.

RESEARCH EFFORT:

TF RECOMMENDATION

<u>1972</u>	<u>1977</u>
6	8

TITLE: Developing methods of farm handling and mixing of feeds. RPA 313-E.

SITUATION: Feed is the most expensive input in poultry production. As vertical integration developed, feed companies became the integrators and contracted with poultry producers to use their feed. This resulted in a squeeze on the producer when profit margins went down. By developing more efficient methods of handling and mixing feed on the farm, more of the profit could be retained by the producer. This increased efficiency would ultimately benefit the consumer as well as the producer.

OBJECTIVE: To develop more efficient methods of handling and mixing poultry feeds on the farm.

RESEARCH APPROACHES:

- A. Determine the minimum size of egg, broiler, and turkey operations for which farm feed mixing is profitable.
- B. Examine economics of obtaining the necessary feed ingredients on poultry farms in different parts of the country.
- C. Develop equipment for efficient handling and mixing of feed on poultry farms of various types and sizes.

CHARACTER OF POTENTIAL BENEFITS: Lower costs of production on poultry farms.

MAGNITUDE OF POTENTIAL BENEFITS: Poultry consume about 39 million tons of feed (in terms of feed units or corn equivalent). Of course, a portion of this feed is already mixed on the farm. If 20 million tons more could be farm mixed at a \$5 a ton cost reduction, the total benefit would amount to \$100 million.

RESEARCH EFFORT:

TF RECOMMENDATION

<u>1972</u>	<u>1977</u>
3	5

TITLE: Determination of fundamental biological balance (ecology) in fish or other marine life and fowl. RPA 313-F.

SITUATION: The relationships between fish and fowl are somewhat tenuous. However, we understand fish are not considered by other task forces, and poultry waste has been suggested as an excellent source of feed for fish. Freshwater fish have great potential for producing large quantities of animal protein per acre. Since fish meal can provide an important part of the diet of poultry, research is needed as to how these species can be combined in an ecological cycle for their mutual benefit and the benefit of man. Possibilities also exist for other marine plant or animal life to become mutually beneficial.

OBJECTIVE: To investigate the optimum balance for an integrated poultry and fish or other marine life cycle.

RESEARCH APPROACHES:

- A. Determine species of freshwater fish best adapted to the use of poultry waste and evaluate their value for human food or animal feed.
- B. Explore the size of pond or lake and the number of fish needed to make most effective use of the waste from a given number of broilers, turkeys, or laying hens.
- C. Determine the extent to which these fish can be incorporated into diets with no detrimental effect on poultry meat or eggs.
- D. Develop efficient methods of harvesting and processing fish from ponds and lakes at the farm level.
- E. Explore marine plants, shellfish, or other marine life that might utilize poultry waste and produce food or feed products.

CHARACTER OF POTENTIAL BENEFITS: Reduce the problem of poultry waste disposal and convert it to a useful food or feed product.

MAGNITUDE OF POTENTIAL BENEFITS: Some research indicates as much as 25% of the ration can be fed in the form of fish meal to poultry without detrimental results. The magnitude of potential benefits would depend upon the success of fish production with poultry waste, the costs of harvesting and processing the fish, the economics of farm fish protein compared with commercially available feed protein, and the economics of otherwise disposing of poultry waste. Another alternative would be production of fish

for human food. This use would make the benefits higher.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>TF RECOMMENDATION</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>
		2	4
<u>Summary</u>			
RPA 313 A		16	17
B		3	5
C		9	12
D		6	8
E		3	5
F		2	4
SAES	25	30	39
USDA	7	9	12
RPA 313 Total	32	39	51

PRODUCTION OF POULTRY AND POULTRY PRODUCTS WITH  
IMPROVED CONSUMER ACCEPTABILITY RPA 409

TITLE: Production of eggs, broilers, and turkeys with more desirable pigmentation properties. RPA 409-A.

SITUATION: Strong demands continue for broilers with deeper yellow skin pigmentation, for eggs with different degrees of pigmentation depending on the use to which they are put, and for turkeys with pigmentation indicating fat deposition in the skin and subcutaneously. Ingredients for imparting the specific pigment desired are often difficult to obtain, and in many instances, premium prices far above the nutrient composition of ingredients are charged in order to provide the pigments. At the present time, synthetic carotenoids are being produced which impart different shades of pigmentation and in all probability, if these are approved for use the cost of obtaining desired pigmentation could be reduced.

OBJECTIVE: To develop specific carotenoid pigments that would impart more desirable pigmentation to skin of broilers, egg yolk, and turkeys to meet more specific consumer demand and to lower the cost of providing pigments in feeds.

RESEARCH APPROACHES:

- A. Evaluate synthetic carotenoid pigments which are being produced by the chemical industry for the different types of poultry and egg products being produced.
- B. Test the effect of other dietary components on deposition of different types of carotenoid pigments in the skin and egg yolk.
- C. Determine the safety for use of different types of synthetic pigments in poultry feeds.

CHARACTER OF POTENTIAL BENEFITS: Reduction in cost of providing pigments in feeds with the simultaneous production of products having more desirable pigmentation characteristics.

MAGNITUDE OF POTENTIAL BENEFITS: It is difficult to give a dollar value. The availability of additional supplies of pigments of different types would enable the poultry industry to decrease the use of many products containing pigments that could be more effectively utilized in the production of other types of animals.

RESEARCH EFFORT:

TF RECOMMENDATION

1972 - 1      1977 - 2

TITLE: Improving the quality of egg shells and albumen and reducing yolk mottling and blood spot incidence. RPA 409-B.

SITUATION: At present probably the greatest causes for loss of eggs in market channels are defective egg shells, reduced albumen quality, and mottled yolks or blood spots in the eggs. It is estimated that close to 5% of the eggs produced are lost by the time they are graded and cartoned because of one or more of these defects. In addition, defects such as blood spots and mottled yolks have a tendency to depress consumption of eggs. Another 5% are broken during delivery to stores, in the food store, on the way home or in the home. Production of eggs with thinner shells and thinner albumen as the production cycle progresses often imposes a limitation on the length of productivity of laying hens. Results of limited research at the present time indicate that improvements can be made.

OBJECTIVES:

- A. To decrease the loss of eggs on the farm and in market channels because of defective shells, poor albumen quality, presence of blood spots or mottled egg yolks.
- B. To increase the number of marketable eggs produced by hens, as well as the productive life of laying hens.

RESEARCH APPROACHES:

- A. Conduct studies on factors which are related to the physiology of egg shell formation.
- B. Determine more effectively what type of chemical and physical changes take place in the thinning of egg albumen in eggs produced during different phases of the production cycle and the relationship to deterioration during storage.
- C. Study hormonal and nutritional interactions in the laying hen that may influence egg shell quality in hot weather.
- D. Investigate different environmental factors which tend to increase the incidence of blood spots in eggs.
- E. Evaluate the effect of different dietary components, feed additives, etc. on the presence of mottled yolk in eggs.

CHARACTER OF POTENTIAL BENEFITS: Reduction in the cost of producing eggs through reduction of losses and through increased productivity per hen.

MAGNITUDE OF POTENTIAL BENEFITS: It is estimated that the total loss from broken eggs, blood spots and other defects amounts to approximately

\$290 million. Increased yield of 25 eggs per hen during her total production life would be equivalent to a cost reduction of approximately \$79 million. Increased demand for eggs because of the production of uniformly higher quality eggs is difficult to estimate, but it might be very substantial.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>

<u>1972</u>	<u>1977</u>
6	7

TITLE: Selection of strains of ducks and geese with lower carcass fat. RPA 409-C.

SITUATION: The strains of ducks and geese produced today have an objectionably high level of fat in the carcasses. This causes decreased consumer demand for this class of poultry.

OBJECTIVE: To produce strains of ducks and geese that will grow as rapidly and efficiently as those we now have, but at the same time have significantly lower percentage of fat in the carcass at the time of slaughter.

RESEARCH APPROACHES:

- A. Conduct breeding studies to determine the heritability of body weight and fat deposits and to produce new strains of ducks and geese that have lower fat content in the body.
- B. Investigate more thoroughly other factors such as diet, environmental temperature, light, etc. which may have an influence on fat deposition in the body.

CHARACTER OF POTENTIAL BENEFITS: The benefits from this type of research would be mainly in the form of an expanded segment of the poultry industry through increased consumption of more desirable products. Benefits may also extend to other segments of the poultry industry where either the distribution of excess fat or inadequate amounts of fat often presents a problem.

MAGNITUDE OF POTENTIAL BENEFITS: At the moment it is difficult to estimate quantitatively the magnitude of this benefit, but if the profitable production of ducks and geese could be doubled or quadrupled, we might possibly have a type of poultry meat which would compete effectively from an efficiency standpoint with broilers and turkeys, and an industry which would be adaptable to other areas of the country.

RESEARCH EFFORT:

TF RECOMMENDATION

1972

1977

2

3

TITLE: Production of specialty poultry product items such as squabs, guinea fowl, pheasants, Rock Cornish, etc. for new and expanded markets. RPA 409-D.

SITUATION: Squab, quail, pheasant, and other minor fowl are presently produced for specialty markets. In 1966, 7 million pounds were slaughtered under Federal inspection. Squab is produced throughout the United States. Quail is available in some areas and may sell for about \$1.00 each (live) at 14 to 16 weeks of age. Both squab and quail are a desirable size for single servings. One airline recently showed interest in quail as an alternate to Cornish hen, but the quail raiser was not able to supply the required 5,000 dressed birds per month. The potential for this type of fowl to provide variety is of interest in part because of the willingness of present buyers to pay a premium for specialty items.

Very little specialization such as has developed in broiler production and marketing has developed for the minor fowl. In general, the production and processing of such fowl will be small scale operations. Whether guidance and assistance could raise production to the level of the duck industry is, of course, uncertain. However, the annual production of 50 million pounds of such birds seems a reasonable goal (this is about 75% of duck production slaughtered under Federal inspection). Research should be conducted to achieve this potential and also to evaluate the possibility of developing systems for production and processing in rural areas. At present, lack of quality controls, slow movement in markets due to spotty supplies, and high costs restrict the development of variety products from minor fowl.

Research effort would undoubtedly stimulate an increase in the production of these products and more efficient production of such birds. We know very little about the specific nutrient requirements of birds such as pigeons, guinea fowl, pheasants (other than young chicks) and special types of chickens.

OBJECTIVE: To increase the efficiency of production of specialty types of birds.

RESEARCH APPROACHES:

- A. Genetic studies will be conducted to improve the reproductive efficiency of the specialty types of birds.
- B. Nutrition studies will be conducted to more specifically define the nutrient requirements of specialty birds.
- C. Develop improved management practices for producing these specialty types of fowl.

CHARACTER OF POTENTIAL BENEFITS: It is possible that the production of this type of bird could be undertaken on a small scale in rural areas by people who do not have the financial and other resources required to engage in the large-scale commercial production of other poultry products such as broilers, eggs, and turkeys. An expanded production of this type of specialty poultry would also benefit other segments of the industry through increasing demand for special feeds, special types of equipment, etc. The variety of poultry products available to consumers would be increased.

MAGNITUDE OF POTENTIAL BENEFITS: A five fold increase (50 million pounds) in the marketing of minor fowl represents a value of about \$40 million annually. Production efficiencies achieved in the broiler industry make it reasonable to expect savings of 10 to 16¢ per pound or \$5 to \$8 million annually.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>
<u>1972</u>	<u>1977</u>
1	2

TITLE: Improve the consumer acceptability of poultry meat through production practices. RPA 409-E.

SITUATION: There is widespread opinion and belief that modern birds used in commercial poultry production today do not have the taste, texture or other qualities that birds of the past had. There is a considerable problem with tenderness in poultry, particularly laying fowl and turkey breeders. Downgrading of poultry carcasses due to breast blisters is common. Occasionally, minor deformities and poor feathering also cause downgrading and a lower return to the producer. Another example of objectionable poultry meat carcasses is a condition described as "slimy chick." This condition results in the carcass becoming very greasy and slippery during processing. Other factors that influence consumer acceptability include aroma, flavor and general appearance.

OBJECTIVE: To reduce downgrading of poultry carcasses and to improve texture, tenderness, and other quality factors that influence the consumer acceptability of poultry meat.

RESEARCH APPROACHES:

- A. Determine whether breast blisters and other defects can be reduced or eliminated through breeding.
- B. Investigate the influence of housing and other environmental factors such as litter, feed, etc. on breast blisters.
- C. Study the relationship of feathering and breast blisters.
- D. Determine whether the type and amount of fat in the diet influence the "slimy" chicken condition.
- E. Determine whether and to what extent breeding, feeding and management influence tenderness, texture, flavor and aroma of poultry meat products.
- F. Investigate the possibility of developing special feed additives, formulations and systems of feeding to improve the tenderness and texture of old birds.

CHARACTER OF POTENTIAL BENEFITS: Reduced losses from downgrading and improved consumer satisfaction leading to increased consumption of poultry products.

MAGNITUDE OF POTENTIAL BENEFITS: The total measurable benefits are estimated to amount to \$157 million annually. Many of the consumer satisfaction benefits are difficult to quantify.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>
	<u>1972</u>
	<u>1977</u>
	2
	2

TITLE: Physiological and biochemical factors influencing growth and development. RPA 409-F.

SITUATION: The production of all types of poultry products with the most desirable amounts of fat and fats of the right composition is difficult to achieve at the present time. Fats may impart objectionable flavors to poultry products or cause processing problems when subcutaneous fat is "soft" fat. Eggs have excessive cholesterol for many people, and also the type of dietary fat may have an adverse influence on egg fat. More efficient synthesis of fat from a physiological or biochemical standpoint would be desirable where dietary fat for incorporation into poultry fat is limited. Problems are encountered with feathering in broilers and turkeys.

OBJECTIVE:

- A. To improve our capability in the production of poultry products with more desirable fat levels and fat of a desirable type.
- B. Improve feathering for better breast coverage in broilers and elimination of pin feathers in young turkeys.

RESEARCH APPROACHES:

- A. Conduct biochemical and physiological studies to investigate factors which influence the rate of fat synthesis in the body, translocation of fat, and the distribution of dietary fats into body tissues.
- B. Investigate factors regulating appetite because of the influence of total dietary intake on fat synthesis and deposition.
- C. Study factors concerned with rates of feathering at various ages.

CHARACTER OF POTENTIAL BENEFITS: It is possible that products of more desirable characteristics from the standpoint of fat content would increase consumer acceptability of poultry products. At the same time benefits through more efficient production would be expected if it were possible to bring about more efficient synthesis of fat in the body from dietary components.

MAGNITUDE OF POTENTIAL BENEFITS: No specific figures available at this time, but consumer satisfaction would be improved.

RESEARCH EFFORT:

TF RECOMMENDATION

1972

2

1977

3

TITLE: Production of broilers and turkeys with a larger percentage of meat and lower carcass content of bone and waste fat. RPA 409-G.

SITUATION: Limited evidence indicates that commercial strains of birds now in use differ in the ratio of meat to bone and in the amount of different types of depot fat. It would appear that some progress could be made in the production of strains of birds that have a higher meat yield or a higher percentage of edible products than those which we are now producing.

OBJECTIVE: To improve broilers and turkeys through the production of strains of birds which yield a higher percentage of edible meat than those now commonly used.

RESEARCH APPROACHES:

- A. Conduct genetic, nutrition and management studies to demonstrate that the proportion of meat to bone in the carcass of broilers and turkeys can be changed significantly.
- B. Determine whether the amount of depot fats observed in different strains of birds is related primarily to genetic differences or to differences in environmental factors such as feed, temperature, light, etc.

CHARACTER OF POTENTIAL BENEFITS: A higher proportion of meat to bone in broilers and turkeys would improve the competitive position of these products in the consumer market of today.

MAGNITUDE OF POTENTIAL BENEFITS: A 5% improvement in edible meat in poultry carcasses would save about \$47 million in production costs to furnish the chicken and turkey meat the task force projects will be needed in 1980.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>		<u>TF RECOMMENDATION</u>	
	<u>1966</u>	<u>1972</u>	<u>1977</u>	
		2		2

Summary

RPA 409 A		1	2
B		6	7
C		2	3
D		1	2
E		2	2
F		2	3
G		2	2
SAES	5	13	17
USDA	2	3	6
RPA 409 Total	6	16	21

NEW AND IMPROVED POULTRY MEAT AND EGG PRODUCTS RPA 410

TITLE: Improved use of poultry in the form of parts and prepared products.  
RPA 410-A

SITUATION: The demand by consumers for prepared products and their preference for certain parts of poultry have led to a need to find uses for backs, necks, skin, fat, bones and giblets. The prepared products, being cooked or partially cooked in most cases, are frequently less stable during distribution than raw poultry. They exhibit a tendency to become rancid (especially turkey products), to have warmed-over flavor and dryness, and color defects. The edible residues sometimes sell for as little as 3¢ per pound for pet food. Excess fat accumulates from further processing operations and presents a utilization problem.

Meat technology, such as information available on the manufacture of sausage-type products, should be adapted to poultry parts and residues and new information developed on the use of skin and on deboning and stability problems that differ from red meat.

OBJECTIVE: To devise ways of making high value convenience products from poultry and better use of edible poultry residues, which include backs, necks and skin from cut-up and further processing operations.

RESEARCH APPROACHES:

- A. Develop a wide variety of convenience products that do not exhibit warmed-over flavors, color defects, or sensitivity to rancidity development. The desirable characteristics peculiar to chicken or turkey should be retained so that consumer appeal can be based on the fact that the products are poultry.
- B. Develop emulsifying and binding agents from hard-to-sell edible poultry parts suitable for use in such items as meat rolls, sausage, casserole dishes and canned items.

CHARACTER OF POTENTIAL BENEFITS: High quality convenience products will improve consumer satisfaction and raise the price the consumer is willing to pay. It will also increase the value of hard-to-market parts and prevent the loss of highly nutritious but inconvenient-to-use edible poultry parts.

MAGNITUDE OF POTENTIAL BENEFITS: Precooked poultry products that enjoy a high quality reputation sell for 4 to 6¢ more per pound than ordinary products. Applied to half the poultry processed beyond the cut-up stage, a 5¢ upgrading yields \$23 million on current production. Increased cost of production would reduce this to \$18 million. About 460 million pounds of hard-to-sell parts results from processing turkeys and chickens beyond the cut-up stage.

Raising the value of these parts from 3¢ to 15¢ per pound yields \$55 million annually. The cost of processing may amount to 4 or 5¢ per pound or \$18 million. The total benefit of \$55 million could easily double in the next 5 to 10 years as the amount of further processing increases.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	12	13

TITLE: Advanced engineering in poultry processing. RPA 410-B

SITUATION: In spite of marked improvements in poultry processing during the past 20 years, further efficiencies are needed because of labor shortages and costs. Certain steps in processing such as killing, bleeding, and evisceration present undesirable working conditions and poor sanitary conditions.

Heat transfer steps involved in chilling and freezing have been largely developed empirically. Water conservation, increased efficiency, and decreased contamination with fecal and extraneous material are goals of research designed to apply engineering principles in a systematic way to the development of improved equipment, facilities, and processing alternatives. Equipment and systems for preparing further processed products frequently involve extensive hand operations (deboning and handling) and delays where microbial problems become critical. Improved use of microwave heating and ways to dehydrate products to meet special needs represent areas where advanced engineering may produce beneficial results.

OBJECTIVE: To design more efficient poultry processing systems that reduce microbiological problems.

RESEARCH APPROACHES:

- A. Determine what alterations in poultry processing can improve work conditions and reduce costs without sacrifice of quality.
- B. Devise ways to reduce water consumption.
- C. Determine applicability of microwave heating and of dehydration methods to the preparation of special products.

CHARACTER OF POTENTIAL BENEFITS: Benefits will consist mainly of reduced processing costs and better efficiency due to improved working conditions and can well include improved quality. These factors are of major importance in this low profit margin industry.

MAGNITUDE OF POTENTIAL BENEFITS: Processing to the ready-to-cook stage costs 3 to 5¢ per pound depending on scale of operation. Cost of labor is about 2¢. Dehydration and further processing costs would raise this figure. A 25% saving in labor costs of 0.5¢ per pound amounts to \$55 million annually. The opportunity for savings is greater in the manufacture of further processed products. Some of the benefits from processing research are included in RPA 410-A.

RESEARCH EFFORT:

TF RECOMMENDATION

1972 - 9

1977 - 13

TITLE: Improve efficiency of production and quality of conventional egg products. RPA 410-C.

SITUATION: A panel of experts reported in 1967 (Pacific Poultryman) that egg product usage will probably increase from the present 10% of egg production to 20 to 30% in 10 years as we develop better ways to handle them. "Mixes will take hold only when they offer extra convenience or better flavor or lower cost than shell egg."

The properties of egg products are altered to varying degrees by processing. Yolk-containing products change during frozen storage; whites must be stabilized before drying; and dried yolk products are subject to oxidative damage. The foaming powers of both white and yolk products are altered by drying. Additives such as sugar and whipping agents are used to reduce the undesirable changes, largely on a trial and error basis.

Egg products are composed of proteins and lipids that interact with each other, that are highly sensitive to heat and cold, that are damaged by shear forces, and that are damaged in some cases by dehydration. Interaction between lysozyme and ovomucin is suspected of causing damage to whipping properties of spray dried whites. Means for controlling this reaction may yield improved egg white products. Increased values should be sought by developing more convenient egg product forms and by finding ways to preserve and enhance at minimum cost the forming, coagulating, emulsifying, and binding properties of eggs that make them uniquely useful in cakes, custards, mayonnaise, salad dressings, puddings, souffles, omelets, meringues, candies, pies, pancakes, and other foods.

OBJECTIVE: To improve the properties of egg products with respect to convenience, stability during processing and storage, and cost.

RESEARCH APPROACHES:

- A. Evaluate the interaction of pretreatments (including the use of additives) and drying methods for egg products in relation to foaming power damage and performance characteristics of dried egg products.
- B. Devise ways to prevent oxidative damage to air-packed yolk products and more reliable ways of stabilizing egg white before drying.
- C. Reduce the cost of processing products by in depth engineering studies on such factors as liquid flow characteristics, heat transfer properties, predrying concentration, homogenization, and ways to handle powders that avoid contamination.

CHARACTER OF POTENTIAL BENEFITS: Egg products having uniformly high performance will increase the value of egg products. Greater efficiency expected from a better understanding of process-induced changes will reduce costs.

MAGNITUDE OF POTENTIAL BENEFITS: Upgrading egg product quality by 10% (approximately the difference in cost of flake and standard dried whites) would represent an increase in value of \$20 million for the \$200 million egg products industry. The cost of doing this and the fact that all products would not be so improved would reduce the benefit to \$5 to \$10 million. Frozen whole egg at 31¢ per lb. in 1966 was 2¢ less than the wholesale price of shell egg (calculated to liquid yield basis). Small scale breaking costs about 5¢ per pound, hence there is a 7¢ per pound saving in the use of frozen egg. Commercial separation of whites and yolks would increase the saving. If usage doubles as quality improves, a benefit of \$42 million on 600 million pounds of products would be realized. Reducing the cost of processing eggs by only 0.5¢ per pound (less than a 10% reduction) would yield a \$6 million benefit when production doubles. The total benefit is estimated at \$10 + \$42 + \$6 million or \$58 million.

RESEARCH EFFORT:

TF RECOMMENDATION

<u>1972</u>	<u>1977</u>
9	10

TITLE: Development of new convenience egg products for domestic and institutional use. RPA 410-D.

SITUATION: Convenience and cost savings are the main reasons for the institutional use of egg products in preference to shell eggs. Industry leaders believe (Pacific Poultryman, 1967) that the use of egg products will increase 2 to 3 fold in 10 years if they offer extra convenience at low cost and with no sacrifice of quality. The usefulness of eggs depends on their heat coagulating, foaming, leavening, antibiotic, binding and adhesive properties. These properties are preserved in products used by the institutional trade. Very few mixes reach household users with the notable exception of angel cake mix. Studies have shown potential for delicatessen items, but development is limited. Intentional modification of the properties of egg products to find new application has received minor attention. The use of enzymes and chemical treatments should be tested as agents to build new properties into egg products that will extend their usefulness. Formulation of convenience items requires knowledge of the interaction of ingredients with respect to the stability of flavor, color, texture, and functional property changes. Cost is of major importance so that efficiency of manufacture must receive major attention.

OBJECTIVES:

- A. To utilize present properties of egg products and modify them where opportunities exist.
- B. To devise new convenience items suitable for household as well as institutional use.

RESEARCH APPROACHES:

- A. Develop products in ready-to-serve or ready-to-cook form that are adequately stable and inexpensive.
- B. Develop mixes that offer high convenience for household use and institutional use.
- C. Develop additional or improved useful properties by chemical or enzymic modification of egg products.

CHARACTER OF POTENTIAL BENEFITS: The consumer continues to show marked interest in convenient-to-use food products. The proposed research will help to fill this desire of consumers. The manufacture of such products thus builds in added value for egg products. The processing of additional eggs will benefit rural area development since many plants that now break eggs are in rural areas.

MAGNITUDE OF POTENTIAL BENEFITS: It is estimated that the built-in convenience features required by consumers will increase the value of plain liquid egg by 20% as a minimum. If half of the expected doubling in egg product usage is due to these convenience products, the benefit would amount to \$20 million annually ( $20\% \times 50\% \times \$200$  million). This would be reduced by the increased cost of manufacture of \$5 million (1.5 to 2¢ per pound liquid basis). Savings in the cost of breaking by institutional users applies also, but has been estimated in RPA 410-C.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	8	8

TITLE: Reduce aging requirement for poultry prior to freezing and further processing. RPA 410-E.

SITUATION: Present commercial poultry processing technology provides for conversion of live birds to convenient high quality frozen food products by rapid, continuous, on-line, economical procedures--with one important exception. This is the need to hold processed poultry for a considerable and variable number of hours before freezing in order to insure that all birds are optimally tender.

Present technological information shows that scalding treatment, severeness of picking treatments and the administration of drugs alter post mortem biochemical changes and tenderness development. The potential for achieving the goal of a short aging time is positive since some birds, even in a uniform lot, require very little or no aging. We need to discover the factor or factors that cause some of the birds to be tender so that we can apply this knowledge to arrive at a treatment that will give uniform tenderness in two hours or less.

OBJECTIVE: To develop economical and commercially feasible methods of accomplishing optimum tenderization for frozen and further processed poultry products in two hours or less compared with present requirements of 6 to 12 hours for many types of birds.

RESEARCH APPROACHES:

- A. Determine the nature of changes that occur post mortem and the factors that influence tenderness development and then devise specific processing or pretreatment steps that will cause all birds to be adequately tender in 2 hours so that freezing and further processing can proceed without the need for aging. Empirical variations of processing steps have failed to give the desired result.
- B. In cooperation with production research workers, determine whether the genetic make up of birds influences either the rate or uniformity of tenderness development to an important degree.

CHARACTER OF POTENTIAL BENEFITS: Cost reductions will result from the elimination of aging for uniform tenderness and consumer satisfaction will be increased because occasional toughness, due to processors' ignoring aging need, will be avoided. The knowledge may also benefit the beef and pork industry, where qualitatively similar post mortem biochemical changes influence product quality.

MAGNITUDE OF POTENTIAL BENEFITS: About 3.8 billion pounds of poultry is frozen or further processed and therefore should pass through an aging step. At 0.4¢ per pound for aging it is estimated that the cost to industry for aging is about \$15 million. It would be expected that two thirds of this cost would be saved if the research is successful. A simple way of avoiding variable degrees of toughness will upgrade the quality of products to yield increased consumer satisfaction. Prime products sell for as much as 10% more than ordinary products.

On 4 billion pounds of poultry valued before processing at \$900 million this would amount to an increase in value of \$90 million. The total benefit of about \$100 million annually would be augmented by any ancillary benefits to the beef and pork industry.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	6	3

TITLE: Utilization of squab and other minor fowl as a means of increasing the variety of poultry products available to consumers. RPA 410-F.

SITUATION: Squab, quail, pheasant, and other minor fowl are presently produced for specialty markets. In 1966, 7 million pounds were slaughtered under federal inspection. Squab is produced throughout the United States. Quail is available in some areas and may sell for about \$1.00 each (live) at 14 to 16 weeks of age. Both squab and quail are a desirable size for single servings. One airline recently showed interest in quail as an alternate to Cornish hen, but the quail raiser was not able to supply the required 5,000 dressed birds per month. The potential for this type of fowl to provide variety is of interest in part because of the willingness of present buyers to pay a premium for specialty items.

Very little specialization such as has developed in broiler production and marketing has developed for the minor fowl. In general, the production and processing of such fowl will be small scale operations. Whether guidance and assistance could raise production to the level of the duck industry is, of course, uncertain. However, the annual production of 50 million pounds of such birds seems a reasonable goal (this is about 75% of duck production slaughtered under federal inspection). Research should be conducted to achieve this potential and also to evaluate the possibility of developing systems for production and processing in rural areas. At present, lack of quality controls, slow movement in markets due to spotty supplies, and high costs restrict the development of variety products from minor fowl.

The study encompasses several disciplines and RPA's.

Reference: Squab raising: Farmers' Bulletin No. 684, USDA 1967.

OBJECTIVE: To provide a wider variety of poultry products by devising efficient management and processing procedures that will yield more attractive products and increase the utilization of squab, quail, pheasant, and other minor fowl.

RESEARCH APPROACHES:

- A. Efforts will be made to prepare specialty types of birds in more attractive ways to stimulate consumer acceptance.
- B. Determine most efficient processing and handling conditions to produce most desirable product forms.
- C. Determine consumer acceptance of various products with respect to quality, acceptable price and market areas.  
(Cooperative with RPA 505)

CHARACTER OF POTENTIAL BENEFITS: The variety of poultry products readily available to consumers would be increased and consumer satisfaction would be raised with regard to quality and cost. Increased production would also increase the opportunity for small business enterprise.

MAGNITUDE OF POTENTIAL BENEFITS: A five fold increase (50 million pounds) in the marketing of minor fowl represents a value of about \$40 million annually. In view of efficiencies achieved in the broiler industry it is reasonable to expect savings from this research equivalent to 10 to 20¢ per pound amounting to \$4 to \$8 million annually.

<u>RESEARCH EFFORT:</u>	T F	RECOMMENDATION
	<u>1972</u>	<u>1977</u>
	3	7

TITLE: Chemistry of reactions that occur among poultry and egg constituents. RPA 410-G.

SITUATION: The color, flavor, texture and nutritive values of poultry and egg products are subject to various alterations during processing and marketing. The properties of constituents vary also with production factors (RPA 409). Increased knowledge of the chemistry of the constituents will provide specific means of evaluating products and improving quality at the point of consumption. Poultry and eggs are composed mainly of proteins and lipids. Many components interact with each other and with other substances at various rates depending on pH, moisture content, and temperature; and even the minor components, quantitatively, frequently affect reactions. Reactions that occur include rancidification, protein denaturation, flavor development on cooking, decrease in whipping properties, browning reactions, and various enzyme reactions. Precursors of flavor that develop during cooking of poultry are incompletely identified. The color defect that occurs occasionally in poultry meat rolls undoubtedly involves myoglobin, but the reason that it only occurs occasionally is not known. Knowledge about the individual components of eggs that are damaged in drying, freezing, and pasteurization will provide a basis for developing specific ways to correct the defects.

Research of this nature is needed to support the studies specified in RPA-410-A to 410-F and should be conducted in conjunction with those studies, but should not be limited to the needs of specific problems.

OBJECTIVE: To provide comprehensive knowledge of the properties and reactions of poultry and egg constituents for use in solving problems of stability, quality, processing efficiency, and new product design.

RESEARCH APPROACHES:

- A. Identify the precursors of flavor and the reactions that lead to flavor and off-flavor.
- B. Characterize the interactions of proteins, lipids, and other constituents at the various moisture activities, ionic strengths, pH, and temperatures encountered in poultry and egg products.
- C. Define the color reactions of myoglobin as influenced by conditions simulating those encountered in the further processing of poultry products.
- D. Provide information about properties of products needed to guide production of products with improved consumer acceptability (RPA 409).

CHARACTER OF POTENTIAL BENEFITS: Thorough knowledge of poultry and egg properties will assure maximum efficiency in processing, marketing, acceptability, and safety of products.

MAGNITUDE OF BENEFITS: Magnitude of benefit is included in RPA 410-A to 410-F, which exceeds \$300 million including benefits from expected increases in further processed products.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>T F RECOMMENDATION*</u>		
		<u>1966</u>	<u>1972</u>	<u>1977</u>
			12	16
<u>Summary</u>				
RPA 410-A				
B		9	13	
C		9	10	
D		8	8	
E		6	3	
F		3	7	
G		12	16	
SAES	22	30	35	
USDA	22	29	35	
RPA 410 Total	44	59	70	

\* To be divided about equally between eggs and poultry meat.

QUALITY MAINTENANCE IN POULTRY MARKETING RPA 412

TITLE: Research to maintain and measure quality during marketing.  
RPA 412-A.

SITUATION: Egg production in 1967 was 5.8 billion dozen, resulting in the first substantial increase in consumption per person in 16 years. During these 16 years consumption per person had declined nearly 100 eggs. Liquid egg production in 1967 was equal to 10.5 percent of the total production compared with the 1961-65 average of 8.8 percent.

The quality of shell eggs in market channels continues to be a serious problem. Eggs, when purchased by consumers, lack uniform quality, are often cracked or broken, and too frequently contain thin and watery albumen, mottled yolks, yolks not uniform in color, abnormal flavor, blood and meat spots and abnormal chalazae. Although considerable improvements in albumen quality have resulted from previous research, eggs are too often sold with cracked shells and other abnormal characteristics which result in decreased consumer satisfaction.

Recent emphasis on Salmonella and other microorganisms, especially in egg products, dictates that additional efforts be directed toward reducing the incidence of these potentially dangerous organisms at the farm level, and at each stage of processing and/or distribution.

OBJECTIVES:

- A. Provide consumers with a constant supply of high quality sound shelled eggs by elimination of all eggs with defects and thin albumens.
- B. Improve methods available for elimination of Salmonella and other harmful microorganisms from shell eggs and egg products.

RESEARCH APPROACHES:

(It is recommended that under RPA 409, efforts be continued, through breeding and feeding, to minimize all low quality eggs at point of production.)

- A. Determine optimum storage or holding conditions necessary for maintenance of initial quality of eggs as received from producers. This includes a study of egg quality changes as related to controlled atmosphere (temperature, humidity, gas composition) and methods for controlling optimum conditions such as sealed refrigerators, cartons, cases or eggshells.

- B. Develop efficient and effective methods for detection and removal of eggs containing defects such as mottled yolks, different colored yolks, heavy chalaza, blood and meat spots and thin albumen.
- C. Improve cleaning procedures through use of effective sanitizers to assure removal of destruction of bacteria from shell surface of all eggs intended for consumer use and for breaking purposes.
- D. Evaluate packaging materials and determine their effect on interior quality changes.
- E. Evaluate wholesomeness or safety of using undergrade eggs (cracked, soiled or containing spots) for potential food use in pasteurized egg-food products.
- F. Continue to evaluate and improve egg quality measurement methods, including such things as electronic devices, sound waves and lightwaves.

CHARACTER OF POTENTIAL BENEFITS:

- A. Uniform, high quality eggs will lead to greater consumer satisfaction.
- B. Reduced losses and improved efficiencies will yield lower costs to the consumers and/or greater returns to farmers on per unit of input.

MAGNITUDE OF POTENTIAL BENEFITS: Losses due to breakage, defects and grade reduction were estimated at \$71.5 million annually (Agric. Handbook No. 291). Reduction of these losses by only 25% would yield an annual benefit of \$18 million. Improvement in the microbiological aspects of shell egg handling will reduce spoilage estimated at several percent of egg production. Reducing spoilage by an amount equivalent to only 1% of production will have a value of \$18 million. Total potential benefit exceeds \$36 million.

RESEARCH EFFORT:

T F RECOMMENDATION

<u>1972</u>	<u>1977</u>
6	8

TITLE: Improved quality of chilled poultry. RPA 412-B.

SITUATION: Although the quality of chilled poultry has improved in the last two decades, there are still several serious problems affecting the consumer acceptance of this commodity. Excessive, unsightly moisture, bruises, presence of pinfeathers, sliminess, off-odors, and possible contamination by salmonellae are all factors affecting the per capita consumption of fresh poultry meat. Even under good conditions of processing, distribution and retailing, the maximum refrigerated shelf-life of ready-to-cook poultry seldom exceeds 7 days. This is primarily the result of multiplication during marketing of spoilage microorganisms present on surfaces of the poultry meat. Methods of processing and packaging as well as environmental factors during distribution and retail handling influence the shelf-life of these products. Practical, economical techniques need to be developed to reduce the initial load of microorganisms--both spoilage and food poisoning types--on raw poultry meat and to inhibit growth of these microorganisms during marketing. Handling, processing and packaging and transportation methods also need to be developed so that high quality chilled poultry meat products exhibiting a minimum of defects, minimal shrinkage and attractive appearance are consistently available at the retail level.

OBJECTIVE: To develop improved handling, processing, packaging and distribution procedures to ensure that raw chilled poultry products made available to the consumer are consistently wholesome and of high quality.

RESEARCH APPROACHES:

- A. Develop optimum methods of handling, processing, packaging, shipping and holding that will reduce the incidence of bruises, minimize shrinkage, enhance physical appearance, and inhibit microbial proliferation on raw chilled poultry products to ensure a minimum of 5 days of refrigerated shelf-life at the consumer level.
- B. Develop practical and effective means of reducing the degree of bacterial contamination of chilled poultry products leaving processing plants by:
  - 1) Determining the role of present processing techniques and equipment in contributing to the degree of bacterial contamination of the final product.
  - 2) Developing improved processing procedures that will result in reduced bacterial contamination of carcasses and cut-up parts.

- 3) Developing more effective equipment sanitation procedures.
- 4) Evaluating physical, chemical or other means (heat, gamma irradiation, chemical dips or sprays, etc.) for destroying bacteria on the final product, with particular emphasis on Salmonella, without adversely affecting the quality of the products.

CHARACTER OF POTENTIAL BENEFITS:

- A. Extended refrigerated shelf-life of raw chilled poultry products.
- B. Consumer confidence that raw chilled poultry products are free of Salmonella and other organisms of public health significance.
- C. Improved economic efficiency of distribution and retailing of these products through better processing and packaging procedures.
- D. Increased profit margin for producer and processor. Improved quality of these products should make them more competitive with red meats and other protein foods and should help in stabilizing the broiler market.

MAGNITUDE OF POTENTIAL BENEFITS: Downgrading of poultry carcasses for bruises, cuts, etc., costs the industry about 75¢ for each 100 pounds of live poultry bought. The total cost for the 14 billion pounds of all live poultry would be about \$100 million. Improved methods of handling live birds and/or carcasses during processing should reduce this loss by at least 1/2 with a net savings of \$50 million.

Spoilage losses at the retail level average about 0.4% indicating that about 40 million pounds of poultry meat are not sold because it is spoiled. At an average cost of 33¢ a pound this amounts to a loss of about \$13 million annually.

Improved processing, packaging and distribution procedures to maintain quality of chilled poultry to ensure a shelf-life in the household refrigerator of a minimum of 5 days should decrease losses due to spoilage to the 0.1% level or less. This would result in a new savings of more than \$30 million.

Thus, a potential benefit of \$80 million may be realized after the objectives of this research are reached.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>	<u>T. F</u>	<u>RECOMMENDATION</u>
	<u>1966</u>	<u>1972</u>	<u>1977</u>
Summary			
RPA 412 A		6	8
B		6	8
SAES	7	12	16
USDA	--	--	--
RPA 412 Total	7	12	16

TITLE: Improvement of grades and standards for poultry and eggs. RPA 501

SITUATION: Grades and standards for poultry and eggs are based largely on subjective measures designed for negotiating transactions among professionals and little understood by consumers who many times choose on completely different quality factors than those considered by the industry. Only a fraction of poultry meat moving through marketing channels is sold under official grade standards as packers and chain stores pack under their own specifications and brand labels. This is also true of eggs, except to a lesser degree. Current grades and standards recognize neither flavor, taste, tenderness nor other points of quality differentiation important to consumers. Nor do current grades and standards differentiate various quality levels for alternative uses of either eggs or poultry meat. Further processing is increasing in importance for both eggs and poultry meat and development of quality standards for such products has lagged--most processors sell such products under their own brands and quality specifications. Consumers thus face uncertainties regarding quality of product when purchasing such commodities.

OBJECTIVE:

- A. To determine quality characteristics for eggs and poultry meat that are relevant to ultimate users.
- B. To develop usable objective measures of these characteristics.
- C. To suggest appropriate grades and standards for various current and newly developed products.

RESEARCH APPROACHES:

- A. Determine technical quality characteristics of eggs and poultry meat and products therefrom for alternative uses.
- B. Study ultimate consumer understanding of technical quality characteristics of eggs, meats, and products therefrom for alternative uses and their relevance to ultimate consumers.
- C. Determine non-technical quality characteristics of eggs and poultry products important to the ultimate consumer.
- D. Determine economic value to ultimate consumer of quality characteristics of eggs and poultry products for various uses and implications to poultry industry returns.

- E. Develop objective measures for economically relevant quality characteristics feasible for use by processors and handlers.
- F. Test consumer reaction to quality characteristics of new products as an integral part of market testing and use information obtained for the development of grades and standards for such products.
- G. Suggest appropriate changes in grades and standards with changing conditions.

CHARACTER OF POTENTIAL BENEFITS: Give users of eggs and meat products for different uses basic quality information that will result in more intelligent purchase decisions and more efficient use of eggs and meat products in alternative uses.

MAGNITUDE OF POTENTIAL BENEFITS: The magnitude of potential benefits cannot be quantified specifically but would consist of consumer satisfactions, more efficient uses of products by industry and perhaps increase consumption and utilization.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	4	5

PHYSICAL AND ECONOMIC EFFICIENCY IN MARKETING POULTRY RPA 505

TITLE: Physical efficiency in marketing poultry and poultry products 505-A

SITUATION: The phenomenal expansion in the production of poultry and eggs on U. S. farms has continued over the past two decades and in recent years has been accompanied by increases in further processed poultry meat and egg product items to serve the rising demand for convenience foods. Although handling and processing has been expedited by many improvements and innovations in methods and equipment and by the development of improved designs for facilities, there still is a great need for improving the efficiency of many of the outdated handling methods and much of the processing equipment. Particularly, research on handling and processing methods, equipment and facilities is needed to reduce both labor and non-labor inputs requirements and consequent operating costs through application of engineering techniques and the adaptation of the many technological advances available to the poultry and poultry products industry.

OBJECTIVE: To improve work methods, equipment and facilities in commercial plants for efficient handling of poultry and poultry products.

RESEARCH APPROACHES:

- A. Determine the labor, equipment and facility requirements for handling and processing poultry and poultry products through the use of engineering research techniques and by improving existing work methods, equipment and facilities to increase operating efficiency.
- B. Develop and test new work methods, equipment and facilities and design and test methods for commercial application of new processes and technique that will increase handling and processing efficiency.

CHARACTER OF POTENTIAL BENEFITS: Reduce cost of preparing poultry and poultry products for market and thereby increase returns to producers and processors while decreasing spoilage hazards at consumer level and overall product cost.

MAGNITUDE OF POTENTIAL BENEFITS: Based on initial research to improve the handling of live broilers, a 50 percent reduction of the present 17.5 per cent bruise rate on 8 billion pounds of broilers would amount to a savings of \$6 million annually. Proportionate savings would be possible in similar losses occurring in other classes of poultry. A 1 percent reduction of cracked eggs would save  $\$5\frac{1}{2}$  million annually.

RESEARCH EFFORT:

TF RECOMMENDATION

1972 - 4

1977 - 6

TITLE: Economic efficiency in producing, assembling, processing and distributing eggs and poultry. RPA 505-B (505,509)

SITUATION: Marketing and production efficiency is directly related to methods and techniques available for commercial application to the various operations required in producing poultry and eggs and in moving products from point of production to point of consumption in the form, time, and place desired by consumers. While the poultry industry has made great strides in reducing the cost of producing and marketing eggs and meat, further reductions are possible. In view of the fact that availability of labor at the farm and processing levels is becoming a problem that grows more acute each day, the application of new methods that will enhance the productivity per man hour in the future in all phases of the industry becomes imperative. The commercial development of new products from eggs and poultry meat is also restricted by manufacturing and marketing methods which result in costs too high for such products to successfully compete in the market-place in volumes large enough to interest large volume retailers. Consumers are thus deprived of a wider choice of products at competitive prices.

OBJECTIVE: To evaluate the economic efficiency of improved methods and equipment for producing, handling, transporting, processing, preserving, packaging and distributing live poultry, eggs, poultry meat, and products derived therefrom: to determine least-cost ways of moving eggs, poultry meat and other poultry products from production point to consumption point for various sizes and types of organization of individual poultry enterprises.

RESEARCH APPROACHES:

- A. Study current production and marketing methods to determine areas where performance can be improved or costs reduced and suggest areas where new processes or equipment would help to better accomplish specific functions.
- B. Suggest possible requirements for commercial application of the manufacture of newly developed products.
- C. Determine the economic feasibility of new processes or equipment.
- D. Determine the impact of new processes or equipment on the relative position of different sizes of poultry business units.
- E. Determine least-cost ways of performing individual production, input-supplying, and marketing functions for particular types of firms.

CHARACTER OF POTENTIAL BENEFITS: Reduction in costs of performing various functions would result in lower cost egg and poultry meat products to consumers. Maintaining efficiency of the egg and poultry meat industries relative to other foods would enhance returns to producers and other productive factors required by the industry.

MAGNITUDE OF POTENTIAL BENEFITS: At present volume of eggs, poultry meat and other products moved at present cost levels, improvement in efficiency of performances of marketing functions would result in a benefit to society of approximately \$30 million per year for each 1% reduction in marketing costs.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
RPA 505	10	8
509	(6)	(6)

TITLE: Alternative methods of coordinating production, input-supplying, and marketing functions for eggs and poultry meat. RPA 505C (505, 509,510)

SITUATION: At the present time, the egg and poultry meat industry is in a period of transition and development of size, structure, and business organization. Various types and combinations of functions are evolving, each with its unique advantages and disadvantages and opportunities for increasing efficiency relative to specific situations. Existing side by side are systems in which each phase of the industry is individually owned and operated for a profit, systems in which producer cooperatives coordinate production and marketing on a voluntary basis, systems in which production and marketing are coordinated through a central agency through contracts, systems in which an individual owns part, or all, of the various phases required to produce and market and who coordinates production and marketing either through contractual arrangements or personal decisions, and systems in which publicly held corporations perform coordination functions through ownership and/or contractual arrangements. Each system has implications with regard to economic efficiency under various conditions, and social implications with regard to land tenure and development of economic market power.

OBJECTIVE: To determine alternative possibilities of coordinating functions to produce least-cost production-marketing systems for eggs and poultry for various types of conditions and assess benefits and costs of each to society.

RESEARCH APPROACHES:

- A. By use of basic cost and efficiency studies developed on a unit basis for various functions, determine how these functions can be combined in coordinated operations to minimize total costs of producing marketing eggs and poultry meat.
- B. Carry out detailed case studies of management performance under various organizational structures involving varying complexities of functions to determine comparative results and limitations of scale on managerial capability.
- C. Develop improved methods for exercising the management function through more flexible organizational structures, effective communication, and group approaches to decision making.
- D. Determine the types of integrated or coordinated industry structures which would best satisfy specific given social goals.

CHARACTER OF POTENTIAL BENEFITS: Benefits to society would accrue through development of more efficient industry with reduced costs and industry organized along lines consistent with specific social goals desired by society.

MAGNITUDE OF POTENTIAL BENEFITS: Each 1% reduction in marketing costs would result in benefits to society of \$30 million per year.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
RPA 505	8	8
509	(4)	(7)
510	(1)	(1)

TITLE: Dynamics of industry structure and performance.  
RPA 505-D (807, 505, 507,509, 510)

SITUATION: Business organization, size, number, and location of firms in the poultry industry are in a process of rapid evolution. The dynamic nature of the changes has implications with regard to producer returns, and the competitive position of producers in various areas of the country. Different forms and sizes of enterprises and the method by which production-marketing is coordinated have different effects upon bargaining power of producers. Superimposed on these changes in structure is a rapidly changing technology which has implications on costs and returns as well as on producer bargaining power and the ability of producers to shift to alternatives. Changes in other sectors of the economy also impinge on producer welfare and their ability to adapt to change and alternative employment. As specialization within the industry increases and available alternatives also demand increased specialization, present producers of eggs and poultry should be alerted to the implications of changes in our economy upon their (the producers) economic future and welfare.

OBJECTIVES: To measure the effect of size, number, method of organization and location of firms on marketing efficiency and performance; to analyze the effects of various forms of producer bargaining power on costs, returns, and organizational structure of the industry; to assess the impact of various changes within and without the industry upon producer returns, size of enterprise, and structure of the industry.

RESEARCH APPROACHES:

- A. Develop least-cost industry systems of production-marketing with respect to size, number, and organization of firms, market demands, and location of production units.
- B. Measure effect of alternative systems of industry organization upon producer returns to labor and investment.
- C. Assess results of alternative methods of increased producer bargaining power on costs and returns for different forms of industry organization.
- D. Measure impact of technological change in production, processing, distribution, and consumption upon organizational structure and geographical location of the industry

- E. Measure impact of change in non-poultry sectors of the economy upon the poultry industry to determine comparative advantage of the industry with respect to non-agricultural alternatives and its effects upon availability of eggs and poultry to consumers.
- F. Measure impact of change in the farm labor force upon producer bargaining power, industry organization, costs and returns, and prices.
- G. Analyze effects of possible unionization of the poultry industry labor force with industrial type contracts regulating wages, work rules, and fringe benefits upon poultry industry structure and geographical location.
- H. Analyze effects of government policy programs on income distribution within the poultry industry.

CHARACTER OF POTENTIAL BENEFITS: Result in information useful to society in developing programs for alternative uses of resources presently used in poultry industry. Also enable the industry to choose among alternative methods of producer bargaining methods designed for socially acceptable method of distributing income within the various phases of the poultry industry.

MAGNITUDE OF POTENTIAL BENEFITS: Each 1% reduction in marketing costs would result in benefits to society of \$30 million per year.

RESEARCH EFFORT:	TF RECOMMENDATION	
	1972	1977
RPA 505	3	4
507	(3)	(3)
509	(2)	(4)
510	(2)	(2)
807	(2)	(2)

TITLE: Pricing Poultry, eggs and related products. RPA 505-E (505,506,510)

SITUATION: Eggs and poultry meat are being traded in a manner that bypasses traditional terminal markets with movement occurring directly from processing agency to chain store warehouse. This more direct movement of product has resulted in efficiencies in handling but has also created problems in price discovery. Price quotations for the product are being set at terminal markets at volumes and quality designations which are no longer representative in terms of market supply and demand. The problem is compounded by the fact that trade takes place on the basis of negotiations from the quoted base price. Furthermore, some of the information being collected today which is important in making price decisions are either inaccurate, unreliable, untimely, incomplete, or non-existent. Also, new methods of pricing--other than on the basis of base quotations--are being investigated by segments of the industry. Consequently, investigations into price determination, alternative pricing systems, and types of information needed for pricing decisions should be expanded.

OBJECTIVES: To study the problems in present pricing systems; to identify factors relating to price determination; to specify information needed for better pricing practices and to suggest possible improvements in present pricing mechanisms or alternative pricing systems.

RESEARCH APPROACHES:

- A. Study prevailing methods of determining basic price levels for eggs and poultry, including the influence of various participants such as producers, processors and handlers, distributors, retailers, and market reporting agencies.
- B. Measure the adequacy of prevailing methods in view of changes in the organization, structure, and geographical location of the egg and poultry meat industries and against various goals such as orderly marketing, distribution of returns, frequency and extent of price fluctuations, and the adequacy of particular prices in reflecting general supply and demand conditions.
- C. Study the effects of various supply and demand factors and institutional policies on the level and variability of prices at various levels of trading, including the influence of such practices as retail price specialing.

- D. Assess the adequacy of current production and marketing information available for pricing and planning and the kinds of information needed to improve pricing and planning. These might include: intentions of broiler hatching egg producers, weekly additions and subtractions from egg laying flocks, weekly inventories and disappearances, bookings of advance orders received by packers and processors and additional weekly retail price data.
- E. Appraise methods of improving present pricing methods through more advanced communication techniques, better and more timely information, wider exchange trading areas, and more appropriate grades and standards.
- F. Evaluate alternative pricing systems such as wider futures trading, committee pricing, formula pricing, decentralized pricing, classified pricing, and other forms of administered pricing as possible substitutes for the present pricing mechanisms.

CHARACTER OF POTENTIAL BENEFITS: Benefits would be related directly to management and coordination of supplies of eggs and poultry meat to market demands. Stability of price and reflection of general supply and demand conditions would enable better planning of production and marketing with possible cost reductions and result in income stability to the various segments of the industry.

MAGNITUDE OF POTENTIAL BENEFITS: Benefits from this activity would, to some extent, be in the nature of intangibles to society--such as the desirability of income stability and stable output of products. Through improved pricing practices and stabilizing devices returns to producers might be increased or consumer prices reduced slightly. If these changes were as much as one-quarter cent per pound of poultry and one-half cent per dozen eggs sold, benefits could total over \$50 million.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
RPA 505	4	5
506	(8)	(10)
510	(1)	(1)

TITLE: Development and expansion of foreign markets for eggs and poultry products. RPA 505-F (601)

SITUATION: Foreign trade in eggs and poultry meat is a very small percentage of total production. Egg imports and exports amount to approximately one-half of one percent of annual production, but can have important implications on price levels if they occur at certain times of the year. Exports of broiler and turkey meat were building up to substantial levels in the early 1950's but trade restrictions imposed by the EEC--whose members were the principal importers--slowed exports to a trickle. Present exports of both eggs and poultry meat are directed to a large extent to non-European buyers many of whom could be classified as poorly developed nations whose capability for importing food for dollars is severely limited. The American poultry industry is capable of producing at low cost and would be able to furnish low-cost, high-protein food to many countries if some way could be found to stimulate demand for our poultry products. This could result in greater returns and more employment in the industry as well as furnishing inexpensive, nutritious food products to many areas of the world. An expansion of research activities in this area promises fruitful results not only in enhancing the financial position of the domestic industry but also in generating good will for our nation in other sectors of the world.

OBJECTIVE: To assess present and potential volume and location of overseas markets for eggs and poultry meat products.

RESEARCH APPROACHES:

- A. Estimate or predict export levels for eggs and poultry meat under conditions of free world trade and analyze effects of such exports on the U. S. poultry industry.
- B. Analyze effect of restrictive trade barriers on demand for U. S. eggs and poultry meat and their effect on the U. S. poultry industry.
- C. Investigate possibilities of increasing foreign demand for U. S. eggs and poultry meat through such agencies as trade agreements, food aid, and other intergovernmental activities.
- D. Determine comparative advantage of U. S. poultry industry relative to possible foreign production areas.

CHARACTER OF POTENTIAL BENEFITS: Benefits from such activity would occur in the form of increased returns to poultry industry and input-supplying sectors if any substantial increase in production for export occurred. Benefits could also accrue to importing nations--if they should be under-developed nations--in the form of high-protein foods that would upgrade the quality of diet, promote health and productivity of their populations, and perhaps enhance their economic growth in some small measure.

MAGNITUDE OF POTENTIAL BENEFITS: Benefits to importing countries of an inexpensive high-protein food would be difficult to quantify. Increasing exports of eggs by 1,000,000 cases would, at present price levels, increase gross returns by at least \$10 million per year while increasing exports of poultry meat by 100,000,000 pounds would increase gross returns to the poultry meat industry by at least \$30 million if exports were filled by increased production. If exports were filled from present production levels, returns to the industry would be even more enhanced by rises in domestic prices due to the price elasticity of the products involved.

RESEARCH EFFORT:

TF RECOMMENDATION

1972

1977

RPA 601

(5)

(6)

TITLE: Development and expansion of domestic markets for eggs and poultry products. RPA 505-G (508)

SITUATION: The development of new and improved egg and poultry products and better means of processing and preserving both current and new products will materially widen the choices of consumers. But the tasks of handling and supplying these items may have substantial impacts on present processing and marketing firms. In many instances, fundamental changes in current ways of doing business or the emergency of entirely new firms and marketing methods may be required. New products and techniques will also need to be market-tested to determine their acceptability to consumers, processors, and handlers, and their probable effects on current products, marketing organizations, levels of consumption of eggs and poultry, and better utilization of sources of byproducts. A continuing program of research will be needed to evaluate alternative products, packages, and marketing methods in order to facilitate orderly change and progress in the translation of products and techniques from the laboratory and the technical stages to the market place.

OBJECTIVE: To assess the feasibility of new and improved egg and poultry-containing products and marketing techniques, and to devise suitable marketing and distributive arrangements. To analyze the impacts on aggregate demand and utilization.

RESEARCH APPROACHES:

- A. Analyze the potential market for and conduct market tests on new and improved egg and poultry products, including adaptation resulting from new processing, preservation, and packaging techniques and both miscellaneous poultry and products using poultry by-products.
- B. Evaluate the comparative costs of producing and marketing new and improved products as compared to current alternatives and practices.
- C. Assess the impacts of new and improved products on current marketing firms and channels, and devise suitable new marketing methods where required.
- D. Determine the impact of new and improved products and techniques on the demand for eggs and poultry in the domestic market under various price and income conditions.
- E. Determine the effects of new and improved poultry byproducts on costs and returns to the producing and processing stages.

CHARACTER OF POTENTIAL BENEFITS: Benefits from such activity would widen the choices available to consumers and might expand the aggregate demand for eggs and poultry and promote fuller utilization of by-product sources.

MAGNITUDE OF POTENTIAL BENEFITS: Benefits to consumers in terms of the increased satisfactions resulting from new and improved products, more convenience foods, and more variety in diets are difficult to quantify. However, every 1% increase in aggregate consumption of either eggs or poultry would add approximately \$20 million to gross farm income.

<u>RESEARCH EFFORT:</u>	<u>INVENTORY</u>		<u>TF RECOMMENDATION</u>	
	1966	1972	1972	1977
RPA 508			(6)	(6)
<u>Summary</u>	RPA 505 A	3	4	6
	B	11	10	8
	C	4	8	8
	D	2	3	4
	E	8	4	5
	F	-	-	-
	G	-	-	-
SAES		13	14	15
USDA		15	15	16
RPA 505 Total		28	29	31

TITLE: Diseases common to man and poultry. RPA 707

SITUATION: The transmission of diseases common to man and poultry are a constant threat to human health. A list of disease producing microorganisms common to man and poultry would include: salmonellae and related infections (e.g., pathogenic Escherichia coli, and Arizona paracolon), staphylococci, mycotic infections, erysipelas, Newcastle disease virus, arboviruses, and psittacosis agents. In addition, consideration should be given to the role of avian influenzae, Rous sarcoma viruses and herpes-viruses in human diseases.

OBJECTIVE:

- A. To gain a full understanding of the mechanism involved in the transmission of these diseases.
- B. Develop control programs which will prevent transmission of these diseases.
- C. Develop improved procedures, equipment and facilities for use in poultry inspection programs.
- D. Determine with certainty whether or not doubtful disease agents are transmissible to humans.

RESEARCH APPROACHES:

- A. Conduct a literature survey to determine the exposure potential of diseases common to poultry and man.
- B. Conduct serological surveys in man and poultry where common diseases are known to occur.
- C. Determine the relationship of avian and human influenza viruses.
- D. Investigate the role, if any, the oncogenic viruses of poultry play in man.
- E. Evaluate the role various processing procedures play in contaminating poultry products.
  - (1) Determine the nationwide incidence of zoonotic microorganisms on poultry and poultry products.

- (2) Determine the fate of coagulase-positive staphylococci in processing poultry
- (3) Develop satisfactory methods for destroying harmful microorganisms in finished poultry products.
- (4) Develop equipment and procedures which will reduce transmission hazards.

CHARACTER OF POTENTIAL BENEFITS: Such studies would hopefully result in a reduction of zoonotic diseases.

MAGNITUDE OF POTENTIAL BENEFITS: The exposure of these agents is highest among those people directly associated with the poultry industry. However, one must also consider the wide distribution of poultry products. It has been estimated that the cost of one of the common disease agents (salmonella) in man is 10 to 100 million dollars annually.

<u>RESEARCH EFFORT:</u>	<u>TF RECOMMENDATION</u>	
	<u>1972</u>	<u>1977</u>
	8	9

RECOMMENDED FOR CONSIDERATION BY  
QUALITY OF ENVIRONMENT TASK FORCE

TITLE: Utilization and disposal of poultry processing waste. RPA 901

SITUATION: Poultry waste consists of feathers, blood, viscera, trimmings, and fecal material. Large volumes of water are used in processing so that about 3 gallons of waste including water are obtained per bird. Pollution type waste from all poultry processing is equivalent daily to that from a city of 1 to 3 million people. Use of lagoons has not been entirely satisfactory and will be under increasing attack from encroaching populations who have instituted law suits and caused plants to be moved. Technological information is needed to develop the most efficient and economical methods of handling such wastes. Suitable ways to reuse water should be sought at the same time.

At present, feathers are converted to a meal used mostly in feed. Generally, viscera, including blood when collected, brings variable small returns to rendering plants. Since feathers are almost a pure protein, possibilities exist for developing more remunerative outlets for this byproduct. A complete system of handling poultry viscera and feathers should be adaptable to a variety of situations. A major need is for processes whereby the processor can convert the waste into a nonperishable form rather than being at the mercy of a single rendering plant or at the expense of long hauls that must be completed promptly.

OBJECTIVE: To devise highly efficient ways to dispose of poultry sewage waste and to utilize poultry byproducts.

RESEARCH APPROACHES:

- A. Devise ways to handle diluted animal waste that will not have odor hazards and that will make the reuse of water possible.
- B. Devise ways to minimize the use of water in poultry processing without sacrificing sanitation.
- C. Develop complete and more remunerative systems including small scale systems for using blood and viscera in pet and other animal feed.
- D. In the light of technical advances in chemistry of proteins re-examine the potential for new products from feathers.

CHARACTER OF POTENTIAL BENEFITS: This research will make it possible for industry to reduce waste disposal costs and to increase returns from marketable byproducts. A major benefit would result from small scale systems of handling waste that would not require immediate sale or disposal of waste. City and county dumps refuse or are reluctant to accept feathers even in an emergency.

MAGNITUDE OF POTENTIAL BENEFITS: Poultry processing yields about 750,000 tons of viscera annually and about 200,000 tons of feathers. A net increase in the return for viscera of \$10 a ton would yield \$7.5 million per year. Feathers now bring \$5 to \$10 per ton. A new use for feathers could bring the price to \$20 per ton for an average increase in value of \$2.5 million. Development of a small scale method of converting waste to stable form would relieve processors of uncertainties about disposal of highly perishable material. If one third of the waste is in this uncertain position, a benefit of \$5 to \$10 per ton would result and add \$2 or \$3 million to the above benefits. Sewage type waste disposal costs may be reduced 25% from that of municipal systems for a saving exceeding \$500,000 (based on annual cost of sewage disposal for a city of 2 million being \$2 to \$3 million). The trend toward further reduction in the permissible BOD in effluents is creating additional problems that will increase costs unless cost saving technological developments are made. Total benefit \$12 million.

RESEARCH EFFORT:

TF RECOMMENDATION

1972

1977

4

6

and the number of individuals in each group. The results of the analysis of variance of the data from the four groups of animals are given in Table 1. The first column gives the mean values of the different parameters in each of the four groups. The second column gives the standard deviations of the mean values.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.

The results of the analysis of variance show that the differences between the mean values of the different parameters in the four groups are not statistically significant. This indicates that the differences between the mean values of the different parameters in the four groups are not statistically significant.



\* NATIONAL AGRICULTURAL LIBRARY

1022203725

NATIONAL AGRICULTURAL LIBRARY



1022203725